A TWO PROCESS APPROACH TO COGNITIVE COMPLEXITY

By

John L. Crum

A DISSERTATION PRESENTED TO THE GRADUATE COUNCIL OF
THE UNIVERSITY OF FLORIDA
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA
1977

ACKNOWLEDGEMENTS

I would first of all like to thank my chairman, Franz R. Epting, for being the person he is and for the innumerable influences he has had on my life. Through contact with him as a teacher, model, and friend, the construct of what it is to be a psychologist has for me been vastly elaborated. I am deeply appreciative of the sincere interest and concern he has always shown me.

I would also like to express extreme gratitude for each member of my supervisory committee. Without exception Robert Allen, Richard Anderson, Gordon Bechtel, Ira Fischler and Dorothy Nevill have unfailingly demonstrated much needed interest and support. All have been extremely gracious with both their time and expertise.

No list of acknowledgements would be complete without mentioning the tremendous contributions of my wife Barbara to both the project and my entire life in graduate school. She was needed both supportively and critically and in many ways made this entire enterprise possible.

Additional thanks also go to my experimenters, Monica, Neal, Jason, Jeff, Myles, and Joseph. Without their help this project would have been impossible.

I would also like to thank my friendly typist, Diane Fischler, who turned a rough manuscript into a readable product. Her willingness to work on short notice was greatly appreciated.

TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS..... ii

LIST OF TABLES..... vi

ABSTRACT..... viii

CHAPTER I. INTRODUCTION..... 1

Cognitive Complexity: An Overview..... 1

Complexity as Differentiation..... 3

Generalizability of Cognitive Complexity..... 6

Measures of Cognitive Structure: Differentiation and Integration..... 10

Demonstrations of the Need for a Two Process Approach..... 14

Goals of Study..... 19

The Measurement of Cognitive Structure..... 20

Differentiation..... 20

Measures of Integration..... 23

Ordination..... 25

Number of Groups Used in Classifying Stimulus Elements 27

Range of Convenience..... 28

Conceptual Systems Test..... 31

Performance on Related Tasks..... 34

Internal vs External Descriptors..... 34

Extroversion..... 36

Page

Repression-Sensitization..... 37

Embedded Figures..... 39

Intuitive Leaps..... 41

Summary of Hypotheses..... 43

CHAPTER II. METHOD..... 52

Subjects..... 52

Procedure..... 52

Session I..... 53

Session II..... 56

CHAPTER III. RESULTS..... 60

Classification Based on FIC and ORD Scores..... 70

Classification Based on FIC and NGS Scores..... 75

Classification Based on FIC and CST Scores..... 78

Classification Based on ROC and ORD Scores..... 80

Classification Based on ROC and NGS Scores..... 84

CHAPTER IV. DISCUSSION..... 87

Evidence for the Two Process Approach to Cognitive Complexity..... 88

A Comparison of Measures of Differentiation..... 90

NGS as a Measure of Integration..... 92

Performance Measures as They Relate to Cognitive Complexity..... 93

The Generalizability of Cognitive Complexity..... 98

Methodological Observations..... 99

Summary.....102

Page

APPENDICES

A. Role Specification Sheet..... 105

B. Response Sheet - Role Construct Repertory Grid..... 107

C. Instruction Sheet - Role Construct Repertory Grid..... 108

D. Instruction Sheet - Ordination..... 110

E. Instruction Sheet - Determining the NGS Score..... 111

F. Conceptual Systems Test..... 112

G. Teacher Rating Form..... 116

H. Health Opinion Survey..... 118

I. Instruction Sheet - Embedded Figures Test..... 127

J. Intuitive Reasoning Instrument..... 129

REFERENCES..... 132

BIOGRAPHICAL SKETCH..... 137

LIST OF TABLES

TABLE Page

1. Means, Standard Deviations and Intercorrelation Matrix for All Variables 61
2. Canonical Correlation of Complexity Variables and Performance Measures 63
3. Multiple Regression of Complexity Variables on Preference for Use of Internal vs External Descriptors.. 64
4. Multiple Regression of Complexity Measures on Intuitive Reasoning 64
5. Multiple Regression of Complexity Measures on Tendency towards Extroversion 66
6. Multiple Regression of Complexity Measures on Repression-Sensitization 67
7. Multiple Regression of Complexity Measures on Embedded Figures Task 68
8. Tests of Significance of Performance Measures for Subjects Classified in terms of Differentiation and Integration Using Functionally Independent Constructions (FIC) and Ordination (ORD) 71

Table Page

9. Tests of Significance of Performance Measures for Extreme Groups of Subjects Classified in terms of Differentiation and Integration Using Functionally Independent Constructions (FIC) and Ordination (ORD).. 74

10. Tests of Significance of Performance Measures for Subjects Classified in terms of Differentiation and Integration Using Functionally Independent Constructions (FIC) and Number of Groups Used in Sorting (NGS)..... 76

11. Tests of Significance of Performance Measures for Subjects Classified in terms of Differentiation and Integration Using Functionally Independent Constructions (FIC) and Conceptual Systems Test (CST). 79

12. Tests of Significance of Performance Measures for Subjects Classified in terms of Differentiation and Integration Using Range of Convenience (ROC) and Ordination (ORD)..... 83

13. Tests of Significance of Performance Measures for Subjects Classified in terms of Differentiation and Integration Using Range of Convenience (ROC) and Number of Groups Used in Sorting (NGS)..... 85

Abstract of Dissertation Presented to the Graduate Council
of the University of Florida in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

A TWO PROCESS APPROACH TO
COGNITIVE COMPLEXITY

By

John L. Crum

December, 1977

Chairman: Franz R. Epting
Major Department: Psychology

In an effort to demonstrate the utility of considering cognitive complexity as an individual difference variable comprised of the subprocesses of integration and differentiation, an investigation was conducted comparing different complexity measures in terms of their relationship to several performance measures. Generally in the past, complexity had been thought to involve primarily the unitary process of differentiation. This study, however, suggested that a more productive approach might include the process of integration as well as differentiation. In this regard, several potential measures of integration were separately evaluated.

Two measures of integration, ordination as developed by Landfield and Barr (1975) and the number of groups used in sorting stimulus elements, were based on Schroder, Driver and Streufert's (1967) idea that integration could be assessed by measuring discrimination capacity. An additional measure based on Harvey's (1967) notion of conceptual system types was included in the study. Two tentative methods of assessing differentiation, the subject's range of convenience

score and Landfield's (1971) measure based on functionally independent constructions were also included in this study. Assessments using these two types of measures were related to subject's performance on five dependent measures. These included preference for the use of internal descriptors in evaluating others, tendency toward extroversion, ability to find embedded figures, intuitive reasoning capability, and typical manner of responding to threatening stimuli.

Although only intuitive reasoning capability could be predicted from any of the measures of complexity, evidence for the utility of the two process approach was demonstrated when subjects were classified into groups on the basis of their scores on the various instruments designed to gauge complexity. Using multivariate analysis of variance procedures, differences were found between subjects classified into groups representing different levels of complexity. The importance of both differentiation and integration was demonstrated by a significant interaction between the two processes as well as the finding of significant main effects for both type processes when looked at individually.

On the basis of its ability to classify subjects into significantly different groups, ordination appeared by far the most appropriate of the measures of integration included in this study. Likewise, Landfield's measure of functionally independent constructions appeared the most sufficient measure of differentiation. Unfortunately, while these were the best of the measures included in this study, they were only minimally useful in predicting the behavior of subjects on the various performance measures. Psychometric properties such as low test-retest reliability were cited as possible contributors to the low validity coefficients.

Some evidence suggesting at least minimal generality of cognitive complexity was also obtained. Interpersonal differentiation was found to be related to ability to differentiate details when embedded in more complex backgrounds. Additionally, individuals with highly integrated systems were found to be better at solving intuitive reasoning problems, presumably because of increased ability to reason via analogy. Surprisingly, interpersonal complexity was only marginally related to variables drawn from the interpersonal realm.

In the face of evidence supporting the viability of the two process approach to complexity, it was suggested that future work in the field be addressed to developing new methods of measuring complexity which both avoid some of the limitations inherent in the current procedures and take into account the dual processes of integration and differentiation.

CHAPTER I
INTRODUCTION

Cognitive Complexity: An Overview

Cognitive complexity has been referred to by Bieri (1966) as the degree to which an individual views his social world in a multi-dimensional way or brings multiple perspectives to bear on a social situation. The implication here is that some people see the world as a complex array of possibilities, while others may tend to view the same events in a simple, relatively fixed manner. This concept of differences between individuals in terms of the multi-dimensionality of their awareness arose from work stimulated by Kelly's (1955) theory of personality. This theory basically put forth the proposition that man acts in a manner which is analogous to that of a scientist and seeks to understand the events of the world by construing on the basis of repeated occurrences. According to this model, the person develops a system of constructs which allows him to give meaning to events as well as to anticipate and predict future outcomes.

System complexity, as it was originally discussed by Bieri (1955), refers to the idea that different people will develop construct systems which vary as to the number of different constructs they contain. Some construct systems will include many constructs (henceforth termed highly differentiated) and according to Bieri's conception be cognitively complex. People who are cognitively simple will, in contrast

to this, develop systems which are undifferentiated and, therefore, contain few constructs. In addition to proposing this type of individual differences variable, Bieri developed a method of comparing cognitive structures which was not tied to a specific content domain. As such, this measure was originally looked upon as a potentially important way of structurally comparing individuals who might have quite different perspectives on the world. As Schroder, Driver, and Streufert (1967) note, measures of cognitive functioning supply a way of dealing with the question of what the person perceives as well as how he processes the information he receives. According to Bieri, individual differences in behavior should result from differences in the number of constructs an individual has at his disposal. For example, it was thought that "the greater the degree of differentiation among constructs, the greater the predictive power of the individual" (Bieri, 1955, p. 263). This hypothesis was based on the assumption that the highly differentiated individual should have a wider range of experience at his disposal to use in forming predictions about the world.

Unfortunately much of the work generated in this field, whether stimulated by this idea or other equally reasonable hypotheses, has yielded conflicting and generally inconclusive results. At the heart of this problem lies the fact that, while the area of cognitive complexity includes a tremendous amount of research, different investigators have often had different conceptions of what exactly is meant by cognitive complexity and how it can be measured. Most often this has simply involved some measure of the amount of differentiation within the individual's construct system. For this reason, it is difficult to evaluate the conflicting results often obtained by different researchers. It is the purpose of this project to attempt to clarify

some of the controversy in the cognitive complexity literature by looking at more complete and hopefully theoretically acceptable measures of cognitive complexity than have typically been used in the past. To effect this goal, measures of complexity will be used which not only include the idea of differentiation between constructs but also the interrelationship or integration of these differentiated constructs within a hierarchical system.

Complexity as Differentiation

Bieri's early work was actually very typical of much of the work in the field of cognitive complexity in that it was primarily concerned with the measurement of cognitive differentiation. In attempting to develop a means of measuring the structure of the individual's experience, Bieri started with the assumption, based on Kelly's (1955) theory, that each person develops his own system of dimensions which he uses in construing his environment. Staying within Kelly's theoretical system he also reasoned that, since propositional constructs allowed the individual to hold alternative views of the world, the greater the number of propositional constructs in the person's system the more ways he should have to look at the world. This type of person should, therefore, be considered cognitively complex by virtue of the multi-dimensional perspective provided by the more differentiated structure of his construct system. Based on this conception of cognitive complexity, Bieri (1955) felt that the increased perceptual ability of cognitively complex individuals should be evidenced in more veridical predictions when these people were asked to predict the behavior of others in common social situations. Tests of this hypothesis showed a significant relationship between these two variables, although the

resulting correlation was not very high ($r = .29$). When these data were analyzed more closely, Bieri found that the highly complex judges accurately predicted differences between themselves and others but not the similarities. Again, however, the validity coefficient for accurately predicted differences was a low, though significant, $r = .35$.

Other investigators also postulated similar relationships between complexity and person perception, and their results have been only marginally successful. Leventhal (1957) found a nonsignificant trend ($p < .10$) suggesting that high cognitive complex judges (high cc) were better predictors of others than subjects low on complexity (low cc). As was the case in Bieri's work, low cc subjects again predicted more similarity between themselves and others than actually existed. Campbell (1965) also reports that low cc subjects assume that others are more like themselves than do those high in complexity. Additionally, low cc individuals were more likely to dichotomize the world in terms of good and bad than high cc subjects, who did not categorize things so rigidly. Other work by Adams-Weber (1969), using a different measure of differentiation, demonstrated a predictive advantage for high cc subjects in that they could more accurately infer the personal constructs of others than low cc judges. In still other investigations of cognitive complexity, as defined by differentiation, and impression formation, Leventhal and Singer (1964) explored the relationship between complexity and the resolution of contradictory information in an impression change study. They found results which supported the idea that low cc judges would show greater change in impression following the presentation of conflicting information. Their results also showed that cognitively

simple judges tended to weigh most heavily outer or external qualities of others' behavior. Complex judges, on the other hand, searched for information concerning the inner motivational states of target persons to use as a basis for their predictions.

In the studies just discussed, the results obtained, while far from impressive in terms of magnitude, all seemed to be consistent in their support of theoretical expectations. This state of affairs has not, however, been typical of much of the research in cognitive complexity. Mayo and Crockett (1964) and Crockett and Meisel (1974), both using different measures of differentiation, report in agreement with Leventhal and Singer (1974) that when presented with contrasting information in an impression formation task low cc subjects changed their impression more than subjects high in complexity. Lundy and Berkowitz (1957) and Scott (1963) both, however, found that their complex subjects changed their impressions more than cognitively simple individuals. In other studies which typify the contrasting nature of the work in this field, Streufert and Driver (1966) showed that complex subjects prefer complex stimuli, while neither Caracena and King (1962) nor Crockett (1965) obtained this finding. It is important to note, however, that the work in the case of Streufert and Driver was based on an early use of an integrative measure of cognitive complexity, while the latter two studies used differentiation type measures.

Additional examples of conflicts in the research literature of cognitive complexity can be seen in several other areas. Supnick (in Crockett, 1965) found what she termed the avoidance hypothesis, which referred to the fact that high cc individuals differentiate more among people they like and have contact with than those whom they

dislike. Miller and Bieri (1965); Irwin, Tripodi and Bieri (1967); and Miller (1969) on the other hand, all found support for the idea that complex subjects tended to differentiate most among acquaintances that they thought were potentially threatening as opposed to those they liked. To some extent this conflict was resolved in the work of Shephard (1972) who demonstrated that the "vigilance hypothesis" of Miller and Bieri only held true when the constructs being rated for complexity were evaluative in nature. Even so, it is quite possible that the conflicting results in this area as well as others arose because different measures of cognitive complexity were used. This could be true even though all approaches discussed thus far, with the exception of Streufert and Driver (1966), were addressed solely to the facet of complexity termed differentiation. Even when complexity was defined in this limited manner, as many as eleven different methods (Leitner, Landfield and Barr, 1976) have been developed to measure this concept, which have not been found to be equivalent to each other (Vannoy, 1965; Epting and Wilkins, 1974). For this reason, much of the confusion that permeates this field may be the result of the failure to develop a generally accepted procedure for measuring cognitive complexity.

Generalizability of Cognitive Complexity

Perhaps the area of investigation most relevant to this study which also has been afflicted with the problem of contradictory results concerns the question of the generalizability of the concept of cognitive complexity to different aspects of human behavior. Early work provided some indication that an assessment of cognitive complexity might indeed be generalizable. Bieri and Messerley (1957), for example,

found a significant relationship between cognitive complexity and the dispositional variable of extroversion. Crockett (1965) attempted to explain this finding using Kelly's experience corollary which stated that a person's construct system varies or develops as a function of his successive construal of the events in the world around him. Crockett's opinion was that an extrovert would be expected to interpersonally complex as a result of his extensive experience with people. Perhaps somewhat more indicative of the generalizability of a differentiation measure of cognitive complexity to different content domains is the work of Bieri and Blacker (1956). These researchers uncovered a significant, but again relatively small, correlation between a subject's complexity score and the number of responses he made to the Rorschach Inkblots, such that high cc individuals tended to produce more responses. Since Rorschach resonses are not necessarily tied to interpersonal stimuli, the results of this study can be seen as suggestive of the idea that an individual who is complex in one area will tend to be complex in other areas, given a certain minimum of experience with the content of that area.

Unfortunately the question of generalizability of cognitive complexity has also generated research which has produced conflicting results. On the positive side, besides the work of Bieri and his associates, are two additional findings by Allard and Carlson (1963) and Epting (1967). In the first study Allard and Carlson presented their subjects with three sets of stimuli, acquaintances, famous people, and geometric designs, and using Rep Grid procedures developed by Kelly (1955), generated the personal structures for each of the three content areas for each subject. Using two differentiation methods of

scoring for cognitive complexity (i.e., those described by Bieri, 1955, and Bieri and Blacker, 1956) these investigators found highly significant correlations between the complexity scores for each subject in each content area. The actual correlations ran between .57 and .67, and all were significant at the .001 level. Additionally, no sex differences were found for cognitive complexity. Epting (1967) also found a significant correlation between complexity measured in two content domains, interpersonal relations and social issues. His correlation coefficients were not, however, as high as those obtained by Allard and Carlson, and he speculated that the finding may have resulted from shared method variance. While these studies would seem to provide evidence for generality of the concept of complexity across content domains, other researchers have found this result difficult to replicate. Hill (1966), using a different differentiation measure based on the variance accounted for by the first factor in a nonparametric factor analysis of Rep Grid data (Kelly, 1963), found little evidence supporting the generalizability of interpersonal complexity. She compared complexity scores on five grids from five different element domains. These included people, animals, fabrics, colored plastic shapes, and art prints. No significant interrelations were found for women and only low ones for males. Thus, these results appear to refute those obtained by Allard and Carlson, and Epting. In attempting to compare thse studies, however, it is important to note that the methods used in measuring cognitive complexity were quite different and not directly comparable, even though Slane and Barrows (1974) did find a significant correlation between these methods.

In other work, Runkel and Damrin (1961), utilizing a rarely used integrative method of measuring complexity based on multi-dimensional scaling, also found no evidence of generalizability complexity scores. In their work they found that during training student teachers varied in complexity as a function of the situation in which they found themselves. Upon starting their student teaching they appeared to be complex but tended to change toward being relatively simple as their training progressed. Once training was completed these subjects normally returned to their former relatively complex status.

Other studies relevant to the issue of the generality of cognitive complexity include the work of Rosenkrantz (1961) and Sechrest and Jackson (1961), both of whom attempted to relate cognitive complexity to intellectual functioning. Interpersonal complexity was not, however, found to be related to either ACE scores by Sechrest and Johnson or SAT scores by Rosenkrantz. As these authors mention, however, it is quite possible that their obtained correlations were attenuated due to the restricted range of intelligence in college population. They maintained that a significant, though not extremely large, relationship might exist between complexity and intelligence. In a somewhat different type of study, Renner and Maher (1962) found no relationship between complexity and the extent of memory of subjects for constructs classified as either dynamic or non-dynamic. A result which can again be interpreted as failing to demonstrate the generalizability of cognitive complexity. In fact, the failure of researchers to produce consistent significant findings for generality of complexity has been interpreted by Crockett (1965) as demonstrating that complexity of cognitive processes need not be equal for all domains of content. In his opinion,

"There are good theoretical reasons to suppose that a complex set of constructs develops with respect to those objects that are of relatively great functional significance in an individual's life, a supposition which implies only a modest degree of generality of complexity across domains" (P. 62). Schroder, Driver, and Streufert (1967) also concur on this point as they suggest the level of development may depend on appropriate experience in the domain being studied.

While these conclusions seem reasonable when the results of the studied just mentioned are taken at face value, the major thesis of this study is that perhaps both the conflicting results obtained in studies of cognitive complexity as well as the lack of evidence for generalizability may be the result of the lack of agreement between investigators on how best to measure the construct. This problem is made particularly acute because researchers in this area have generally confined themselves to assessment techniques which focused solely on either differentiation or integration concepts,but have seldom attempted to look at both processes simultaneously. The view represented in this study, however, is that neither differentiation nor integrative measures of cognitive complexity may be sufficient methods of measuring this dimension when used alone. These two processes may be only minimally related and yet may both be important characteristics that need to be included in any attempt at describing cognitive structure. For these reasons, measures based on only one of the two processes may have little chance of producing positive results.

Measures of Cognitive Structure: Differentiation and Integration

The idea that it is necessary to include both differentiation and integration measures when addressing cognitive structure has a

long and diverse history. Lewin (1951) noted that, while it was necessary to consider differentiation (i.e., the number of distinct elements in a region of the individual's life space) when attempting to predict his behavior, it was also necessary to also consider the hierarchial organization of the person's system. In the area of cognitive development, Werner (1957) discusses growth in terms of success periods of differentiation (elaboration of viewpoints) and integration (the consolidation of varied perspectives into a more unified whole). Angyal (1941) even earlier noted that personality development was characterized by dual processes which included the differentiation of individualized parts and the integrative organization of these separate parts into a general system. Kelly (1955) also makes this point in many places but perhaps most clearly when he discusses both the experience and organization corollaries of his theory of personal constructs. In the experience corollary he lays the groundwork for the idea of differentiation as he says "A person's construction system varies as he successively construes the replication of events" (p. 72). Crockett (1965) interpreted this as meaning that the more experience a person has with events of a given domain the more constructs he is likely to develop to explicate his understanding of those events. By saying that "Each person characteristically evolves for his convenience in anticipating events, a construction system embracing ordinal relationships between constructs" (p. 56), Kelly also implied that it is not just the number of constructs a person develops which explain his behavior but rather how he uses the constructs at his disposal in an organized manner. Bannister and Mair (1968) also make this same point as they say, "A single construct by itself would allow no predictions,

since it is along the line of interrelationships between constructs that predictions are made. Only when constructs are interrelated and organized into some kind of system can they form the basis for consistent or useful application" (p. 15).

In spite of the long history of the above ideas, most investigators in this field have not considered it necessary to separately address the characteristics of differentiation and integration in trying to measure cognitive structure. Bieri (1955), for instance, felt differentiation alone was structually related to complexity as he considered the more complex structure to generally be the more differentiated one. For this reason, Bieri felt that differentiation measures alone might provide adequate assessment of complexity.

Some researchers have, however, taken an opposing stance on this issue. A separate approach to cognitive structure emphasizing primarily the idea of integrative complexity was initiated by several teams of investigators (e.g., Harvey, Hunt and Schroder, 1961; and Schroder, Driver and Streufert, 1967). According to these researchers, measures of differentiation based on the number of observed dimensions are insufficient because they are "not necessarily related to the integrative complexity of the conceptual structures, but the greater the number of dimensions the more likely is the development of integratively complex connections or rules" (Schroder, Driver and Streufert, 1967, p. 7). From their perspective, high integration involves connections between dimensions which may be referred to as rules which allow for more alternative perceptions, "contain more degrees of freedom, and are more subject to change as complex changes occur in the environment" (p. 7). More to the point, their view is that integrative measures

provide a way of assessing how a person combines the information which he both perceives and generates internally. Integration measures are, therefore, seen as directed at measuring how the individual processes the information at his disposal rather than addressing the range of material that he is able to process, which might be seen as a question of differentiation.

In addition to the viewpoints of these scientists, a few individuals have recognized the need for both types of approaches to conceptual configuration. Zimring (1971) expressed the view that differentiation and integration are separate processes both of which needed to be considered in trying to understand cognitive arrangement. MacNeil (1974) while also recognizing this need, proposed that the processes of both differentiation and integration could each be subdivided into two subprocesses. According to his system, discriminative complexity is a function of both differentiation and articulation, while integrative complexity can also be broken down to two subprocesses termed dimensional and role complexity. Unfortunately, while there may be some benefits to attempting to understand the processes of integration and differentiation in better detail, MacNeil's distinctions between processes are often unclear and somewhat difficult to operationalize. Additionally, his ideas on how to measure the processes of differentiation and integration run counter to other researchers (e.g., Leitner, Landfield and Barr, 1976). For instance, MacNeil proposes a measure of what he terms articulation, an aspect of differentiation, which is identical to a measure Landfield has developed, called ordination, for measuring integration.

Demonstrations of the Need for a Two Process Approach

An early empirical demonstration of the need for the two types of measures of cognitive structure can be seen in the work of Bannister (1960, 1962). He used a complexity measure which he called intensity score that was based on the degree to which all of the constructs in a sample of a subject's system clustered together. Generally, high intensity scores, because they indicate the existence of few independent dimensions, were equated with relatively simple systems. Low scores, on the other hand, were thought to mean that the subject was using many independent constructions and, thus, should be classified as high in complexity. The inadequacy of classification based on this type of methodology was demonstrated when Bannister compared the intensity scores of schizophrenics to normals. When he did this he found that members of the schizophrenic population had lower intensity scores than were typically found in the normal population, thus implying higher complexity. While it may make some conceptual sense to think of schizophrenics as having many diverse ways of looking at the world, they should not strictly be thought of as cognitively complex. Their thought processes can probably more reasonably be termed random as opposed to organized. This idea was supported in Bannister's work as normals were consistent in how they used their constructs in a later sort of similar objects while the schizophrenics were not consistent.

The major thrust of this work is that differentiation measures alone may not be a sufficient way of classifying cognitive processing. The basis position of this paper is that differentiation and integration are independent processes, both of which are necessary to consider when attempting to describe cognitive structure. As Crockett (1965)

notes, "A cognitive system will be considered relatively complex in structure when (a) it contains a relatively large number of elements and (b) the elements are integrated hierarchially by relatively extensive bonds of relationship" (p. 49). Factor analytic studies of both types of measures seem to support the notion of separate aspects of complexity. Vannoy (1965) factor analyzed the results of a number of complexity measures, including several integrative type measures. In doing so, he found no large common factor among the different measures which could be interpreted as complexity. This he considered strong evidence against the idea that cognitive complexity was a generalized trait. It is possible, however, that his lack of positive results may have been due to an inability to effectively assess cognitive structure with the measures he used. Given the diversity of assessment techniques used, many of which had little theoretically in common except their use of a unidimensional approach to complexity, the lack of great overlap is perhaps not that damaging. Indeed within the context of this presentation, the lack of relationship between the differentiation type measures and integrative ones is to be expected. In another study, Slane and Barrows (1974, in Leitner, Landfield and Barr, 1976) compared several measures of complexity and found overlap between differentiation measures based on elicited constructs. Measures using provided constructs also represented a separate factor. Additionally, as might be expected, an integrative measure was found unrelated to differentiation measures. Furthermore, the integration measures did not load on any factor with differentiation measures. These results were at least more encouraging than those of Vannoy as these investigators found that different assessment techniques based on similar methodologies all came out as part of the same factor.

Further evidence for the independence of measures of differentiation and integration can be seen in the work of Epting and Wilkins (1974). In this study, the authors compared two measures of each aspect of complexity in terms of their ability to predict the integration of discrepant information about a single individual. This study demonstrated clearly that differentiation and integration represented independent processes since the highest correlation between either type of measure was only .31. Additionally, a stepwise discriminant analysis showed that the best predictions of the integration of discrepant information were obtained when a differentiation measure developed by Crockett (1975) was used in conjunction with an integrative measure based on Harvey's (1967) notion of conceptual systems types.

Using somewhat different methods Leitner, Landfield, and Barr (1976) provide a strong theoretical basis for recognizing the importance of differentiation and integration. Additionally, the work of Landfield and Barr (1975) provides empirical support for this position. These authors drew heavily on Kelly's (1955) original position and stressed the importance of the nature of the hierarchial organization in the person's construct system. They were particularly interested in what they called construct ordination which they felt represented the relationship between constructs at different levels of abstraction. This they assessed in relation to a dimension of meaningfulness basing their work on the assumption "that a person who conceptualizes feelings, ideas, and people at different levels of significance can make such discriminations only if there are integrating conceptions within which he may order these differences in significance" (Leitner et al., p. 47). In addition to the ordination score, Landfield and Barr assessed

differentiation through the number of functionally independent constructions (FIC) used by each subject in completing Kelly's Rep Grid. Using the ordination score as a measure of integration and the FIC score as a measure of differentiation, Landfield and Barr dichotomized their subjects in terms of being above or below the mean on these two variables. By doing this they were able to assign all of their subjects to one of the four quadrants obtained by crossing the two dimensions. They were then able to compare the subjects in the different classifications on various dependent measures using a Chi-square analysis. Since their effort was mainly directed at demonstrating the importance of thinking of complexity in terms of both differentiation and integration, Landfield and Barr were concerned with finding differences between groups of high differentiating subjects who varied on the dimension of integration. Basically they felt two groups if individuals could be identified within the high differentiation category, the low integrating person who might be confused and the individual high on integration who should be better adjusted.

When the variable of meaningfulness of self, as defined by extremity of ratings used when the subject was asked to rate himself on each construct dimension, was used as the dependent measure it was found that high differentiating, but low integrating subjects obtained lower self-meaningfulness scores than people in the other three quadrants. This same result was found when meaningfulness of others was considered as a dependent variable. On the average, other people also rated the high differentiating, high integrating (HH) subjects as being more meaningful than the group of high differentiating, low integrating (HL) subjects. With regard to still another dependent variable, the

subject's ability to predict how others would rate him, it was found that HH subjects were better predictors than HL individuals. When just differentiation scores were considered, persons with lower levels of differentiation were found to be more predictable. Additionally, when integration scores were looked at alone, it was observed that high integrating subjects were, at least initially, better predictors of how others would view them within the context of others' constructs. Overall this study was significant in that it demonstrated the usefulness of thinking of complexity in terms of both the dual processes of differentiation and integration and their interaction, despite some methodological questions concerning the assessment of integration which will be considered later.

Another attempt to look simultaneously at measures of integration, differentiation, and their interaction can be seen in the work of Langley (1971). This investigator administered to his subjects a modified version of Kelly's Rep Grip and developed a unique way of operationalizing his measures. Extent of integration was determined by the number of constructs which were highly related (i.e., were used in the same way to sort either 12 or more, or 3 or less stimulus figures), while amount of differentiation was determined on the basis of medium relationship (i.e., either 10 or 11, or 4 or 5 matches in the use of constructs). Twenty subjects were preselected to represent the extremes of each of the same four quadrant classifications used in the study by Landfield and Barr. Measures of several dependent variables were then used to compare the performance of the subjects in each of the four quadrants. With this type of paradigm, it was found that the measure of differentiation discriminated between subjects in terms of

their capacity for analytic performance on the Concealed Figures Test. The integration classification, on the other hand, showed a significant relationship with functioning on the Test of Intuitive Leaps developed by Wescott (1961). Although both integration and differentiation were shown to be related to certain types of performance, this study failed to demonstrate significant interaction effects for the two independent variables. Unfortunately, the effects that were found were of the expected kind but too small to reach statistical significance. On the basis of these results, Langley concluded that refinement of measures of integration and differentiation "seems necessary before further tests of interaction can be profitable, but appropriate general theories alrealy seem to exist to guide the attempt" (p. 23).

Goals of Study

This study will attempt to follow the direction suggested by Langley and will try to demonstrate the usefulness of some theoretically relevant measures of integration when used in combination with a measure of differentiation. It is the further goal of this research to investigate the possibility of a significant interaction between these two processes. Additionally, while attempting to pursue these goals, this study will also be directed at comparing the utility of several different measures of integration. Finally, an attempt will be made to look at the generality of interpersonal cognitive complexity across content domains by using several types of dependent measures which are not directly related to the individual's interpersonal construct system.

The Measurement of Cognitive Structure

Differentiation

By far the vast majority of the research conducted in the field of cognitive complexity has been based on some sort of measure of differentiation. As stated earlier, the normal assumption has been that greater differentiation will in general reflect greater cognitive complexity. Although this assumption must be thought of as rather tenuous, based on the conflicting nature of obtained results, there has been no dirth of techniques designed to measure this dimension. Most of these have been based either on determining how many unique constructs a subject produces in a given type of situation or the number of different ways he uses his constructs to sort acquaintances. Often this has involved the use of Kelly's Rep Grid in some form (e.g., Bieri, 1955; Bieri and Blacker, 1956; Bieri et al., 1966; Adams-Weber, 1969; Landfield, 1971). Some attempts, however, have been independent of Kelly such as those developed by Scott (1962) and Zajonc (1960) in which subjects were required to sort a number of elements into groups that they felt belonged together. Extent of complexity was indexed by the number of non-overlapping groupings.

In other work, Jaspars (1963) factor analyzed grids and equated complexity with the explanatory power of the first factor extracted, reasoning that the smaller the amount of variance accounted for the greater the differentiation in the system. Some researchers have even used provided constructs instead of elicited ones (Bieri et al., 1966; Tripodi and Bieri, 1963). Crockett (1965) has also developed a unique measure of differentiation which was based on the number of

descriptors used by a subject in writing three minute character sketches for each of eight acquaintances.

Because of the wide variety of measures of differentiation, there is little consensus among investigators as to which is the most appropriate method. Complicating the problem is the fact that few of these different measures have been found to be related to each other (Epting and Wilkins, 1974; Vannoy, 1965). Some studies do, however, suggest that measures with provided constructs may be the least appropriate. Jaspars (1963) found that while there was no difference in complexity scores for normals using provided constructs instead of the elicited ones, there were differences for populations which in some way deviated from the norm. Additionally, Slane and Barrows (1974; reported in Leitner et al., 1976) found that measures using elicited constructs all loaded on the same factor, while those using provided constructs formed a different factor. In contrast to this, there is the finding of Wilkins, Epting, and Van de Riet (1972). They found that the Bieri et al. (1966) complexity measure using provided constructs differentiated between sensitizers and repressors. Bieri's (1955) measure using elicited constructs, however, did not. Despite these results, the weight of the evidence appears on the side of measuring differentiation through a method using elicited constructs.

For purposes of this study, a method developed by Landfield (1971) based on what he termed functionally independent constructions (FIC) was chosen as the technique for measuring differentiation. Given the lack of empirical evidence clearly demonstrating the superiority of one method over another, the decision as to which technique to use to

measure differentiation was made primarily on theoretical grounds. Methods other than Landfield's were deemed less satisfactory either because they were not closely tied to the theoretical assumptions of cognitive complexity or because they had obvious measurement shortcomings. Bieri (1955), for example, developed a method of measuring differentiation which looked at the construct patterns used by the subjects in classifying various acquaintances. This method seemed to represent a reasonable way of judging the similarity of constructs based on how they were used, thereby avoiding the problem of subjectively judging similarity. This problem was inherent in the method used by Bieri and Blacker (1956). Unfortunately, Bieri's original method did not allow the subject the option of specifying a construct as not applicable to a given acquaintance. Instead he was forced to align at least one pole of a given construct dimension with each stimulus figure. For this reason, judgments of similarity between constructs may have been artificially inflated, especially in cases where constructs were only marginally applicable. Measures of differentiation based on the variance accounted for by the first factor of a factor analysis were eliminated because it was felt that the explanatory power of the first factor said nothing about the partitioning of the remaining variance. At best this was only a very indirect measure.

Landfield's (1971) method was finally selected because it not only used elicited constructs but allowed the subject the option of not using a construct to rate a given acquaintance when he felt this was appropriate. This method also had the added feature of recognizing the possibility of inverse relationships between constructs, as well as direct ones, so that constructs are judged to be similar if the pattern of

construct usage between them is significantly inversely related. This again is something that is not directly handled by the techniques developed by Bieri and his associates. Other measures of differentiation based on the number of constructs produced in a given time span, such as in the method developed by Crockett (1965), were eliminated for two reasons. In the first place it was thought that the number of constructs produced might be too strongly influenced by verbal ability, a factor not theoretically related to complexity. Perhaps even more limiting is the fact that this method depends upon subjective judgment of similarity between constructs, as does the method of Bieri and Blacker (1956). Therefore, it may not take into account the personal nature or idiosyncratic use of these dimensions by subjects.

Measures of Integration

In attempting to measure the extent of integration in a person's cognitive system the goal is, according to Crockett (1965), to "yield a determination of the relationships among constructs from which inferences may be made as to the proportion of constructs in the system that are related" (p. 52). The classical approach to this problem has been to attempt to determine how many dimensions a person uses in making judgments through the use of multi-dimensional scaling techniques (Hayes, 1958; Todd and Rappoport, 1964). While this might, as Schroder et al. (1967) suggest, be the method of choice for investigating the integrative nature of cognitive structure, all things being equal this is not a very practical method. If the complete method of triads were used for making all comparisons involving 15 stimulus persons, this would involve 455 judgments of similarity

for each subject. Even though these judgments may be such that they are conceptually easier than deciding which end of a construct dimension best applies to a given person, the sheer number of comparisons involved makes the task much too tedious to be of practical use.

In the face of a lack of a firm theoretical basis on which to choose an alternative method of determining integration, four different measures will be compared in terms of their ability to describe cognitive structure. Three of these methods do not, in the terms of Schroder et al, strictly address integration, but are rather seen as what they term measures of discrimination. According to these authors, discrimination measures are indirect estimates of integration which are based on the idea that the more integratively complex the cognitive structure of the individual the more ways he has at his disposal for perceiving a given stimulus array. Dimensions which are integrated, or abstractly organized, are expected to be able to allow the individual to identify a wide range and variety of stimuli. Additionally, the existence of hierarchical organization provides the mechanism for the incorporation of many divergent types of information within the overall system of the individual. This, in turn, allows for a greater variety of possible discriminations. Thus, the more integrated or abstract the system the greater its potential for use of information. Beyond this, "One necessary condition of a complex discriminative dimension is a capacity to organize and measure a wide range of stimuli. A second abstract characteristic is the presence of many finely separated categories on the dimension, in terms of which many aspects of stimuli can be discriminated" (Shroder et al., 1967, pp. 174-175). High discriminative ability, which implies high abstraction or

integration, also allows for a high tolerance for ambiguity, since an abstract system makes it possible to delay stimulus assignment while many complex characteristics are being analyzed. Finally, high level discriminative functioning might be characterized as having the ability to reorganize flexibly in the face of new stimulus information. Based on these assumptions, these authors note several possibly measurable manifestations of high discrimination. The characteristics suggested by these authors include the measurement of the range of stimuli included in a particular categorization, the fineness of discrimination in dimensional categories, the capacity to delay final assignments of stimuli and the demonstration of flexibility of processing information on a given dimension. Assessment techniques based on the first two of these charcteristics will be used in this study.

Ordination

The first discriminative type measure that will be used in this study is Landfield's and Barr's (1975) concept of ordination. This measure was discussed earlier in this paper and is founded on the premise that the number of discriminations a person can make using a given construct dimension is dependent on the way that construct is related to other constructs in his system. The greater the hierarchical organization the more discriminations he should be able to make. In the words of Leitner et al. (1976), "To the extent that the person can employ more levels of meaningfulness, i.e., he is more ordinated, as he considers his descriptions and people, one may assume that the person is

utilizing certain integrative, higher order conceptions" (p. 47). According to this idea, higher order conceptions are the product of using multiple constructs simultaneously in an integrated fashion. As described, ordination appears to be a discrimination measure based on the assessment of the degree of fineness of discriminations made by the subject on a given dimensional category. In their definition of this type of measure, Schroder et al. (1967) say, "Increasing fineness in discrimination is associated not merely with an increasing number of categories into which stimuli can be sorted, but also with an increase in the number of fineness of gradation between categories" (pp. 176-177).

This measure of integration has the initial advantage over other possible methods of measuring integration in that it has some demonstrated utility (Leitner et al., 1976). Unfortunately the primary dependent measure in their study was meaningfulness, as judged by extremity of placement used when rating various people on construct dimensions. Therefore, the relationship between the two variables may be the result of shared method variance. Arguing against this idea, however, is the fact that the correlation between these two measures was only .14. MacNeil (1974) in particular casts doubt on the ability of ordination to appraise the hierarchical organization in cognitive systems as he argues that this type of measurement is really addressing what he terms articulation, an aspect of differentiation. Indeed Leitner et al. mention a .32 correlation between FIC score and ordination, which represents as extensive a relationship as is often found between different measures of differentiation.

Given this controversy and the need for additional research using this measure, it is perhaps best to think of ordination as only one possibility for addressing cognitive structure. In this vein, Schroder et al. (1967) note that even though an assessment technique is conceptually related to integration when operationalized it may be less than effective. For this reason, the purpose of this investigation is not only to assess the usefulness of ordination as a measure of integration but to compare its utility with other possible measures of this concept.

Number of Groups Used in Classifying Stimulus Elements

A second possible method of addressing integrative complexity was suggested in Kelly's (1955) original work when he said that the ability to make useful predictions is indicative of the interrelationships between constructs and only when constructs were organized would they serve as useful in anticipating the future. Based on this premise, it might be suggested that the more integrated a person's conceptual system the greater the variety of ways he will have to use his individual constructs. Therefore, if asked to sort elements into similar classes on a given construct dimension, the integratively complex individual should tend to produce more independent groupings than the person with the more modest cognitive system. This conception of how a complex system will function is also shared by Schroder et al. (1967), who wrote:

> A request that the subject arrange or scale stimuli in object sorting or Rep Test categories is particularly important; for if a subject simply lumps a number of stimuli into a nominal category, then discrimination is poor, whatever the number of stimuli involved. It is the number of discrimination per category that should best relate to abstractness. (p. 176)

This measure is actually somewhat related to Landfield's concept of ordination in that it is a discrimination measure used to estimate the fineness of the discriminative capabilities of the person on a given dimension. The major difference between the two methods is that the idea of ordination is based on a second order inference founded on the idea that the number of different points along a scale that a person uses in rating a stimulus object is indicative of the limits of his discriminative capabilities. This, in turn, supposedly reflects the extent of integrative complexity in this system. Sorting or grouping elements on a construct dimension, on the other hand, may be a less artificial task and additionally one which may be less prone to be influenced by response set factors. It is, therefore, hypothesized that an estimate of integrative complexity based on the number of groupings used by a subject across all of his construct dimensions will be a more adequate integration measure than an estimate based on ordination scores.

Range of Convenience

A third method of appraising integration was also suggested in the discussion by Schroder et al. concerning the use of measures of discrimination in estimating hierarchical organization. According to these authors, one of the properties of an abstract or integrated system is the ability to embrace a wide range of potential stimuli. To use Kelly's (1955) own terms a construct which is able to embrace a large number of diverse events is said to have a wide range of convenience. In thinking about this concept, a construct which is part of an organized system should be able to encompass more stimuli per

dimension than isolated constructs which provide for only dichotomous classification. The assumptions behind this method of assessing cognitive structure are in many ways the same as those underlying the measures discussed earlier. Systems which recognize the existence of a number of gradations of recognizable but not defining stimulus characteristics should be more potentially useful in classifying more elements than systems which depend solely on the existence or absence of one critical attribute. As an example, a construct which allows for the existence of various shades of grey on a dimension of black and white should be useful in classifying more stimuli than a construct which only will subsume objects which are clearly black or white.

Support for a particular method of operationalizing this approach can be seen in the results obtained by Hayden (1977). He used a procedure developed by Hinkle (1965) for measuring the amount of relationship between constructs in a given system. Hinkle had demonstrated that he could measure the amount of structure in a sample of a construct system by assessing the number of implications possessed by each construct. According to his reasoning, constructs which were part of a hierarchically organized system would be tied to other constructs in the system by inferential linkages. Thus, when one construct was applied to a situation simultaneously the use of other related constructs was also implied. As a demonstration of this relatedness, Hinkle proposed that when a person changes the way he classifies an element with regard to a construct dimension the number of implied changes brought about on other dimensions by this reclassification is indicative of the inferential linkages between the constructs. As he predicted, the greater the amount of relationship in the system the greater the

number of implications possessed by each construct. Unfortunately Hinkle's procedure, while perhaps a potentially good measure of integrative complexity, is extremely time consuming and tedious for the subject. The importance of Hayden's work was that he found a correlation of .72, $p < .001$, between a subject's range of convenience score and the total number of construct implications in his system. This would certainly appear to support the view that the extent of the range of applicability of a subject's construct system is directly proportional to the amount of relationship between constructs within the system.

Basically the importance of this approach to assessing cognitive structure over the methods using ordination and classification is the ease with which the information can be collected. When standard Rep Grid procedures are used, the subject's range of convenience can be calculated by simply counting the number of times a subject says his constructs can not be applied to a group of stimulus elements. The greater the number of non-applicable cases the less integrated his system. Given the discussion thus far on measures of integration, it is predicted that there should be a strong relationship between measures of integrative complexity based on the number of groups used in classification and range of convenience, as both share the same underlying assumptions. The relationship between these two measures and ordination, while also expected to be positive, should not be as high given possible methodological problems in scoring the latter measure. Additionally, it is hypothesized that techniques based on the concepts of both range of convenience and classification will be more efficient measures of integration owing to the possible existence of response style bias in assessing ordination.

Conceptual Systems Test

A fourth approach to appraising hierarchical organization which was used in this study differs from previously discussed methods in that it is not directly tied to Kelly's Rep Grid procedures. Rather, it is based on the work of Harvey and his associates (Harvey, Hunt and Schroder, 1961; Harvey, 1967; Harvey, Prater, White, and Hoffmeister, 1968). While these investigators also contend that the conceptual systems developed by individuals vary in terms of their integrative complexity, they go on to indicate that differences on this variable are reflected in the manner in which the individual processes the information. The person low on integrative complexity is seen as possessing what is termed a concrete system which will process information in only a very fixed manner. Dimensions in this type system are often dichotomous and, therefore, allow for only minimally graduated possible discriminations of stimuli. Thinking is seen as typically categorical and behavior is anchored to external conditions. In a slightly more integrated system, which might be termed moderately concrete, there is the emergence of some alternative ways of construing the world which were absent in less integrated systems. Still at this level there is little conceptual apparatus for relating or organizing these differentiated perspectives.

For individuals operating at the next highest level of complexity, referred to as moderately abstract, there is the ability to develop rules for relating and choosing between alternative conceptions of reality. These type of people are able to combine different perspectives, although the arrangements of stimuli generated by alternative sets of rules are still relatively fixed. Nevertheless, the viewpoints of

these individuals are less deterministic and there is more reliance on an internal attribution in attempting to understand the world. In contrast to the moderately abstract individual, the most complex or abstract person relies more on the use of underlying theoretical principles for the generation of rules he uses in processing information. People operating on this level typically see themselves as much less determined by external forces. The abstract individual is also more willing to accept, and deal with in an integrated fashion, types of information which may in some ways seem contradictory. Thus, the abstract person has a much greater tolerance for seeming ambiguity.

In developing this conception of cognitive structure, Harvey (1967) was primarily concerned with the manner in which individuals function in dealing with stimulus information. He was not, however, concerned with addressing either the separate ideas of integration or differentiation. Rather, it was his contention that "Concreteness-abstractness, as we have characterized and validated the construct, refers to a superordinate conceptual dimension encompassing such more molecular organization properties as the degree of differentiation, articulation, integration and centrality of the cognitive elements" (p. 205). For this reason, perhaps the dimension of concreteness-abstractness should not be thought of as a pure measure of integration, although it would certainly seem more related to this aspect of cognitive complexity than to differentiation. For the purposes of this study, however, the type of conceptual system possessed by the individual will be considered as an assessment of system integration, as has been assumed by several other investigators (e.g., Epting and Wilkins, 1974; Leitner, Landfield and Barr, 1976).

Assessment of the individual's level of conceptualization will be accomplished using Harvey's (1967) Conceptual Systems Test (CST). This test was developed from responses made by subjects to an earlier (Harvey, 1966) semi-projective sentence completion test called the "This I Believe" test. In contrast, the CST is an objective test scored on the basis of extent of agreement or disagreement with various items. This measure was found by Epting and Wilkins (1974) to correlate .31 with the Bieri et al. (1966) measure of differentiation. This may well reflect Harvey's (1967) contention that his conceptual systems approach includes both the concept of integration and differentiation. Epting and Wilkins also found this measure to be the best predictor of an impression formation task, although the extent of the relationship was not significant ($r = .25$).

The use of the conceptual systems approach to cognitive structure was included in this research because the concept was thought possibly to relate more to general functioning across content domains than the measures described earlier. The first three measures of integration that were discussed, as well as the appraisal of differentiation through FIC scores, specifically assess aspects of complexity of interpersonal relationships, while the CST may be the embodiment of a more generalized approach. If this is the case, then the person's CST score may be more related to performance in areas unrelated to interpersonal relationships than the other measures of complexity. This is a particularly important consideration in view of the questions concerning the generalizability of cognitive complexity. If interpersonal complexity does not tend to be generalizable to other content areas, then assessments of the cognitive structure within this area would be only

minimally related to performance on tasks depending on complexity in other areas. Measurement of CST on the other hand, since it addresses general functioning, may show at least some relationship to behavior in several different content areas.

It is the hypothesis of this study that all the various gauges of cognitive complexity based on interpersonal relationships will show maximal relationship to variables dealing with people. Additionally, it is predicted that there will be some generalizability of cognitive structure so that these same measures will show a significant relationship, though perhaps of lesser magnitude, to performance on tasks drawn from other content domains. Additionally, it is hypothesized that the measurement of integration based on CST, given its general nature, will show a more uniform relationship to the various performance measures included in this study.

Performance on Related Tasks

Since most of the methods of estimating complexity used in this study involve the interpersonal domain, the best chance for demonstrating the need for including measures of both differentiation and integration in conceptions of cognitive complexity should involve relating these measures to behavior dealing with people. Two variables involving the interpersonal realm were, therefore, used in this study.

Internal vs External Descriptors

Leventhal and Singer (1964), in researching the relationship between cognitive complexity and impression formation, report that cognitively complex individuals seem to have the tendency to make judgments

of others based on the "inner substance of people," while subjects low in complexity appeared more concerned with the surface behavior of others. This difference was later utilized by Schneier (1976) while investigating the influence of cognitive complexity on behavior in a field setting. He predicted that, in a situation where employees of a chemical manufacturing plant were asked to indicate their preference for using various dimensions to rate their fellow coworkers, cognitive complex workers would tend to prefer internal dimensions, while cognitively simple subjects would rate external qualities as more important. Significant differences of this type were found as complex subjects gave the highest preference ratings to internal constructs and low complexity individuals preferred to use external characteristics. As might be expected, both of the preceding studies used differentiation type measures of cognitive complexity. In interpreting these results, complex individuals evidently seem to see people as governing their own behavior and, thus, place emphasis on their intentions or assumed motivations. Less complex individuals, perhaps because they do not have the structure which allows them to do otherwise, take things at face value and are partial to judging others in terms of their clearly defined actions.

For the purposes of this study, it was felt that if this preference for internal qualities by the complex individual is a product of his ability to use his cognitive structure to make valid inferences about others, then the person most able to do this should be the person who is high on integration as well as differentiation. Individuals high on differentiation may be able to see others from different perspectives, but without an organized structure based on the relationship

between constructs they may have difficulty inferring nonconcrete aspects of others. Similarly persons with a very integrated, but not very differentiated, system will probably be limited in terms of the number of alternative ways they have of viewing others. For this reason, they may be prone to take the easy route and describe others in terms of their nonconflicting concrete attributes. Clearly individuals who are low on both differentiation and integration should be even less likely to think of others in terms of internal qualities. The major hypothesis of this part of the study is, therefore, that there should be a joint effect for the processes of integration and differentiation such that individuals high on both dimensions should express the greatest preference for using internal attributes in rating others. At the other extreme, persons low on complexity, as determined by their position on both differentiation and integration, should have a strong preference for judging others in terms of external characteristics. Those individuals high on one continuum but not the other, or in the middle of both, should show no marked preference for using either internal or external qualities in describing others.

Extroversion

A second criterion which is conceptually and empirically related to interpersonal complexity is extroversion (Bieri and Messerley, 1957). This personality construct is theoretically related to interpersonal complexity in that the development of high complexity is thought to depend upon experience in a particular content domain (Harvey, 1966; Crockett, 1965). If this can be assumed, then certainly the type of person most likely to have broad experience in dealing with other

people is the extrovert. A person with this sort of disposition actively seeks out interactions with others and in general should be more likely to experience a wide variety of different types of relationships than the introvert. Since this kind of individual views relating to others as functionally important and since his ability to be successful in such relationships may be dependent upon accurately predicting the behavior of others, he should tend to develop a cognitive system which is highly differentiated and also organized. A complex system of this type should allow the extrovert to see others from varying perspectives and possibly make relatively more accurate judgments of them. Once again a joint effect is hypothesized as high complexity, as determined by high relative standing on both differentiation and integration, is expected to be related to extroversion. Low scores on both these dimensions should coincide with measured introversion. Individuals falling between these extremes of complexity should tend to be characterized by neither extreme introversion or extroversion. Empirical support for the relationship between high complexity, as defined by differentiation alone, and a tendency toward extroversion, as measured by the Rorschach, can be seen in the work of Bieri and Messerley(1957) who found a significant correlation between the two measures.

Repression-Sensitization

In addition to the two variables mentioned above, which seem to be directly related to the domain of interpersonal complexity, three other measures were used in this study. These were included in an attempt to demonstrate the existence of at least moderate generalizability

for cognitive complexity across content domains when measurement is based on techniques which include the concepts of both differentiation and integration. The first of these measures involved the assessment of the quality termed repression-sensitization. As originally conceived by Byrne (1961), this dimension represented a continuum along which individuals could be ordered with respect to their characteristic mode of responding to threatening stimuli. Classically repressors are thought to be characterized by use of defense mechanisms such as denial and repression, while sensitizers tend to use obsessive and intellectual defenses. Repressors have also been shown to have higher thresholds for potentially threatening stimuli (Tempone, 1962). Wilkins, Epting and Van de Riet (1972), using both these data and Crockett's (1965) ideas on the role of experience in the development of complex cognitive structures, hypothesized that "repressors would avoid anxiety producing situations and it would follow that their construct dimensions for evaluating and representing such environmental stimuli would be either nonexistent or at most poorly differentiated" (p. 9). Evidence for this hypothesis was found as sensitizers had a higher differentiation score than repressors or normals on the differentiation complexity measure developed by Bieri et al. (1966). While high differentiation has been empirically shown to be related to sensitization, Schroder et al. (1967) hold that high integration may also relate to this type of behavior. Their opinion was that individuals with highly abstract systems (i.e., highly integrated) should be more capable of making fine discriminations between stimuli and, thus, be more aware of slight changes in the environment. It is just this type of behavior which typifies the sensitizer who is more likely to be aware of changes

in stimulus arrays, especially in potentially threatening situations. Following both this line of reasoning and that established by Wilkins et al. (1972), it is postulated that sensitizers will tend to be characterized by both high differentiation and high integration, while repressors should tend to be low on both dimensions. Individuals relatively high on only one dimension or in the middle of both are expected to be identified as showing the tendencies of neither repressors nor sensitizers.

Embedded Figures

A fourth variable of interest which might be useful in demonstrating the importance of both integration and differentiation in the measurement of cognitive complexity is performance on the Embedded Figures Test (EFT), developed by Witkin (1950) using Gottschaldt's complex figures. This test has been demonstrated to be related to Witkin's (1950) idea of cognitive style. According to Witkin, Dyk, Faterson, Goodenough, and Karp (1962), people vary on a cognitive style dimension, the extremes of which are represented by either analytical or global types of functioning. Global persons are those individuals who are dependent upon the perceptual field for making judgments. Analytical people, on the other hand, are able to perceive items as discrete from the background when the perceptual field is structured. Their ability to do this is thought by Witkin (1969) to reflect the presence of cognitive differentiation with regard to the environment. Analytical functioning is then associated with greater psychological differentiation and global functioning with less differentiation. Conceptually, this is quite reasonable. A person with an analytic cognitive style should be more adept at dealing with details

of situations than an individual functioning in a global manner. The existence of such a capability can easily be seen as dependent on the ability to discriminate many aspects of a given stimulus array. This type of cognitive style may, however, be the result of not only the ability to differentiate among aspects of the environment, but may also be related to the efficiency with which the individual can discriminate between very similar stimuli. As such, this capability should depend upon not only sufficient differentiation but also higher order integration.

Although the connection between cognitive style and integration remains to be demonstrated, there is some support for an association between analytic performance and differentiation. As described above, preference for use of internal constructs has been show to be characteristic of the complex individual, as defined by extent of differentiation (Leventhal and Singer, 1964; Schneier, 1976). Bieri, Bradburn, and Galinsky (1958), additionally, have found that poor EFT performance is correlated with the tendency to use external constructs in response to the Rep Test. Based on this information, the inference can be made that low complexity is associated with the inability to solve embedded figure problems quickly. A clearer demonstration of the relationship between cognitive complexity and analytical vs global styles of functioning can be seen in the work of Langley (1971). In one of the few studies using both integrative and differentiation measures, Langley hypothesized that performance on a group test similar to the EFT, called the Concealed Figures Test, would be related to both dimensions of complexity. Specifically, he postulated that the greater the differentiation the higher the analytic capacity. Beyond this, he also

felt that for subjects high in differentiation high integration would impede analytic functioning, while for those subjects low in differentiation high integration would enhance performance. Support was found for his first hypothesis but not for the assumed interaction between differentiation and integration. With some justification, Langley attributed his failure to inability to measure system integration adequately. This led him to the conclusion that the interaction of these dual processes might be demonstrated with revised measures of integration. In conducting this project, theoretically based methods of assessing integration like those called for by Langley were used, but his assumption about the interaction between differentiation and integration and its effect on EFT performance was not shared. The position taken in this study is that, based on Schroder et al.'s (1967) conception of integrative information processing, integration will not impede analytic functioning. Instead, it is hypothesized that, although differentiation may by itself be related to cognitive style, high integration should further enhance analytic capacity since it should allow for greater discrimination between aspects of stimulus arrays.

Intuitive Leaps

Wescott (1961) developed a method of studying an approach to problem solving, which he observed in many individuals, that was characterized by the subject advancing solutions when the relationship between provided evidence and the correct conclusion was obscure or perhaps even totally lacking. This type of behavior he termed problem solving by intuitive leaps. In his earliest work, he demonstrated that some individuals consistently advanced attempted solutions even when presented with little information. Other people, however, tended to delay their

solution attempts until they received a great deal of data. Those individuals who attempted a solution when provided with little information were typified as reasoning by intuitive leaps. Some of these subjects were consistently more successful at using this type of strategy than others. Given the success of some individuals in this kind of endeavor, it can be assumed that functioning is not based on wild guessing. Thus, what has been termed reasoning by intuitive leaps may be a function of degree of problem solving ability instead of the result of the use of different problem solving strategies. In this vein, correct problem solution for individuals using what others would term insufficient information may depend not upon the use of intuition proper, but rather upon an efficient way of generating reasonable solutions. A possible explanation for this ability may be that these individuals have developed sufficiently organized conceptual systems which allow them to produce quickly logical alternative solutions by such means as reasoning by analogy.

Support for the relationship between system integration and intuitive efficiency can be found in the previously mentioned study by Langley (1971). Individuals high on his measure of integration also tended to possess high intuitive efficiency. Additionally, there was a nonsignificant trend $p < .12$ suggesting that subjects high on integration but low in differentiation were more efficient than individuals high on both dimensions. As might be expected, those subjects low on both aspects of complexity evidenced the least efficient performance. With these results in mind, the inclusion of a measure of reasoning by intuitive leaps in this study is particularly interesting. Not only will an attempt be made to relate cognitive structure to a

performance variable, but in this case, it is the individual processing only moderate complexity who is expected to show the most efficient behavior. Persons high on both dimensions of complexity are expected to be handicapped, though not as much as those low on both integration and differentiation, by virtue of their high differentiation which may act to reduce maximum integration. Thus, it is predicted that there should be a main effect for integration such that the highly integrated person should consistently out perform the individual low on this dimension. An interaction effect should also be evident since maximal functioning should be found in the high integrating but low differentiating subject.

Summary of Hypotheses

Basically, this study is addressed to the general question of viability of considering cognitive complexity as a process reflected by the dual components of differentiation and integration. To that end, it is hypothesized that performance of the subject on the various dependent measures will be related to both of these components of complexity. The importance of both aspects of complexity should be reflected in the weighting of the independent measures using both canonical correlation procedures and multiple regression prediction formulas for each of dependent measures. Specifically, the following prediction is advanced.

Hypothesis 1:

Measures based on both the concepts of differentiation, as measured by the subject's FIC score, and integration, as determined by the use of four

potential measures of this factor, will individually contribute significantly to the variance accounted for on each of the dependent measures. In other words, measured aspects of complexity will relate to performance on the dependent measures.

As discussed previously, four different possible approaches to system integration will be evaluated in terms of their predictive utility in this study. Three of these measures, ordination (ORD), range of convenience (ROC), and number of groups used in classifying stimulus elements (NGS) are based on aspects of Schroder et al.'s (1967) notion of integration as reflected by capacity for stimulus discrimination. Since each of these measures is based on similar conceptions of integration, it is expected that the three measures should be significantly related. Scores on Harvey's Conceptual Systems Test (CST), however, should not be strongly related to the other three measures of integration since this test purports to index the combined effects of both system differentiation and integration. Additionally, none of these four measures, with the possible exception of the CST scores, should be strongly related to the subject's differentiation score since these two types of scores are supposed to reflect independent processes. In attempting to contrast the four approaches to system integration, several predictions will be made as follows:

Hypothesis 2:

Measures of integration based on NGS scores and ROC scores will be better predictors of subject performance on the various dependent measures than

integration scores based on ordination because of the possible existence of response style bias in the latter measure.

Hypothesis 3:

Since Harvey claims that his Conceptual System Test addressed both the differentiation and integration components of cognitive structures, scores derived from this test should show a greater relationship to subject's performance than scores based on either of the separate components of cognitive complexity. More specifically, the subject's CST score should be the best single predictor of the subject's performance on the various criterion measures. It is also predicted, however, that the three remaining theoretically based measures of integration should do an even better job of accounting for the variance in the criterion variables when used in conjunction with the subject's differentiation score.

An additional area of interest related to the idea of cognitive structure concerns the question of the generality of system complexity to various content domains. To address this question, several different types of criterion variables were included in this study. Since three of the scores representing integration (i.e., NGS, ROC, and ORD), as well as the differentiation measure, will be determined within the content area of interpersonal relations, these scores should be maximally

useful in predicting variables related to interpersonal relations. Hypothesis 4 is thus as follows:

> Hypothesis 4:
>
> Complexity scores based on the content domain of interpersonal relations will show highly significant correlations with the two criterion variables related to the interpersonal domain. These two variables include the subject's preference for using internal or external constructs in describing others and his extroversion score. Additionally, the various measures of interpersonal complexity should demonstrate at least a moderate degree of generalizability as evidenced by significant, albeit moderate, correlation with the remaining dependent measures. The individual's CST score, if it represents as claimed a general approach to cognitive structure, should not show this differential pattern of predictive utility. Instead, the subject's CST score should show a more uniform relationship to the performance measures. In general, a low but significant correlation is expected between the subject's CST score and each of the criterion variables.

In addition to looking at the extent of correlation between the various predictors and criterion variables, analysis of variance procedures will be used in an effort to demonstrate the existence of joint effects for both the differentiation measure and each of the integration

type measures. Four separate 2 x 2 factorial analyses were initially planned in which subjects were classified into groups based on their scores on each of the variables that were thought to reflect cognitive structure. Subjects were classified as being either high or low on each of the five measures relating to complexity. Only those subjects who could clearly be classified into one of the four groups obtained by separately crossing the factor of differentiation with each of the indices of integration included in this analysis. Using this method, there were four groups into which a subject could be classified: 1) high on differentiation and high on integration (HH); 2) low on differentiation and high on integration (LH); 3) high on differentiation and low on integration (HL); and 4) low on both differentiation and integration (LL). Four separate analyses were planned so that each of the approaches to measuring integration could be looked at individually. Multivariate analyses of variance procedures were used to look for differences between the groups using all five dependent variable scores at the same time. If integration and differentiation are separate components of cognitive complexity, then certain joint main effects might be predicted. Predictions for each of the dependent variables using the analysis of variance model just discussed are as follows:

Hypothesis 5:

Based on the work of Leventhal and Singer (1964) and Schneier (1976), it is hypothesized that there will be a main effect for differentiation with highly differentiated subjects showing a preference for using internal as opposed to external

descriptors in describing others. Beyond this, it is also hypothesized that there will be an interaction effect such that HH subjects will show a greater preference for the use of external descriptors than subjects high in differentiation but low in integration.

Hypothesis 6:

The use of a second interpersonal variable, based on the measurement of tendency toward extroversion, stems from the work of Bieri and Messerley (1957) and Crockett (1965). From their position it is expected that significant main effects for both differentiation and integration will result in LL subjects obtaining the lowest scores on the extroversion scale of the Maudsley Personality Inventory and HH subjects obtaining the highest. Individuals in the remaining two cells (i.e., HL and LH) should obtain intermediate extroversion scores. At the very least a significant main effect for differentiation should be found such that highly differentiated subjects will appear the most extroverted.

Hypothesis 7:

As the tendency to respond to Byrne's Repression-Sensitization scale has been found to be associated with high differentiation (Wilkins, Epting and Van de Riet, 1972), it is hypothesized that there

will be a significant main effect for differentiation for this variable. Highly differentiated individuals should score as sensitizers and undifferentiated subjects as repressors. It is further hypothesized that high integration will work in conjunction with high differentiation so that HH subjects should have the highest sensitization score. Likewise, LL subjects should produce scores indicative of high repression.

The ability to find embedded figures quickly in a complex stimulus array has been shown to be related to high differentiation (Witkin, 1969). Since his notion of cognitive complexity is based on differentiation in a content area quite removed from interpersonal relations, the existence of significant relationship between ability to find embedded figures and interpersonal complexity should provide the evidence for the generality of complexity across content domains. Since these content areas are quite removed from each other, the magnitude of the relationship between the variables should not, however, be very large. Within the analysis of variance framework, the nature of the relationship is hypothesized as follows:

Hypothesis 8:

Individuals high on differentiation should show greater ability to find embedded figures than subjects low on differentiation. Additionally, those persons high on integration should do better on this type of task than those with relatively unintegrated systems. For this reason, HH subjects

should be able to find the embedded figures more quickly than individuals in the other cells. Following this line of reasoning, poorest performance should be found for LL subjects.

Interestingly, these predictions run counter to those made by Langley (1971), as he postulated an interaction effect for integration and differentiation. His idea, which was not supported by his results, was that the ability to identify embedded figures would be enhanced by high system integration only if the person were low in terms of differentiation. Subjects who were high on both differentiation and integration were expected to do relatively poorly as system integration might impede analytical functioning.

The final criterion variable used in this study was a measure of each subject's ability to solve series problems using intuitive leaps. The inclusion of this variable was deemed important because it was the only variable which had previously been demonstrated to relate to a measure of integration. Additionally, while main effects for both integration and differentiation were predicted for most of the other dependent measures, an interaction effect between integration and differentiation was predicted for this variable.

As suggested by Langley (1971), the ability to solve problems by making intuitive leaps may be dependent upon comparing the present problem to analogous ones solved in the past. The ability to do this may, in turn, be dependent upon having a highly integrated cognitive system which allows for the judgment of similarity between seemingly different stimuli. Highly differentiated systems, regardless of the extent of system integration, should not be as efficient in dealing

with these types of problems. In highly differentiated systems different problems may be viewed as completely independent. The following hypothesis is, therefore, advanced:

> Hypothesis 9:
>
> Those individuals who are high in system integration but low in terms of differentiation should be the same ones who are most efficient at problem solving by intuitive leaps. Subjects who are low on both integration and differentiation should, on the other hand, have little basis on which to solve problems by way of analogy. They should, therefore, show poor performance on this task. Intermediate performance is expected for those subjects in the HH and HL classifications.

CHAPTER II
METHOD

Subjects

Subjects drawn from the introductory psychology pool were used in this experiment. In total there were 117 subjects used in this experiment of which 44 subjects were males and 73 were females. All of these students took part in the study in partial fulfillment of course requirements. The average age was about 19 as most were college freshmen and sophomores.

Procedure

All subjects in beginning this study were first briefly introduced to personal construct theory and given some general information regarding their role in this research. They were informed that this study was primarily concerned with investigating how they view people in their lives. Additionally, they were told that this research involves some unconventional problem solving tasks which could be considered more like puzzles than intelligence tests. The use of the term of cognitive complexity was avoided to reduce the likelihood of a subject biasing his behavior as a result of misconceptions about the term, which might lead to evaluation apprehension. To allay other possible fears any questions were answered and the complete anonymity of the subject was stressed. All subjects were told that they would be

required to take part in two experimental sessions and an appointment was set up at this time for the second phase of the study.

Session I

A modification of Kelly's Role Construct Repertory Test (Rep Grid) based on the work of Landfield (1971) was used to obtain a sample of the constructs the subject uses in differentiating acquaintances. Those constructs were, in turn, used in conjunction with the subject's acquaintances to assess the extent of both the differentiation and integration in his system. In beginning the Rep Test portion of the first session, the subject was asked to fill out a specified list of role titles for 15 acquaintances (see Appendix A). If the subject could not think of a person to fill a given role, the title was modified until he was able to list someone. The names of these individuals were written across the top of the first rating form (see Appendix B) given the subject, as well as individually transcribed on 15 index cards. Once this was accomplished, the subject was asked to generate 15 construct dimensions using the instructions contained in Appendix C While producing these constructs the subject was also asked to use these dimensions to sort each of his acquaintances. To accomplish this each subject was asked to merely indicate which pole of each construct most applied to each element. If neither pole applied or if he could not decide which should be used, he was also asked to indicate this information. Data accrued in this manner were used to both determine a subject's differentiation score and the total range of convenience of this sample of his construct system.

Extent of a subject's relative differentiation was determined on the basis of the number of Functionally Independent Constructions (FIC) he used on the Rep Test. Determination of the FIC score was based on comparisons of patterns of construct usage. Constructs were compared with regard to the similarities and differences of their applications across individuals. Each construct was individually compared to each of the other 14 sampled constructs. A total comparison score was computed by counting the number of times a role figure was rated in the same way on the two construct dimensions. If the similarities totaled 12 or greater out of the possible 15, the two constructs were judged to be functionally equivalent. If the total number of similarities was three or less, the constructs being compared were again thought of as equivalent only inversely related. The total FIC score was determined simply by counting the number of separate construct units employed by a subject on the entire Rep Test. A separate unit score was recorded any time a construct was unrelated to any other constructs, whenever a group of constructs was unrelated to any other constructs, and also for each group of constructs which clustered together. Two separate FIC subscores were computed by comparing patterns across both the constructs and the elements generated by each subject. These subscores were then added together to produce the total FIC score. The range of convenience (ROC) score was calculated from the same source of information as the FIC score. The ROC value was, very simply, the total number of times a subject said a given construct dimension did not apply to a given element.

The second part of the first session was used to assess the remaining three measures of integration. After filling out the Rep Grid

as discussed above, the subject was next asked to rate each of the acquaintances, which had been elicited during the Rep Test, on each of his construct dimensions. Basically this was done using a 13 point (-6 through zero to +6) semantic differential type scale, the complete procedures for which can be found in Appendix D.

Ordination scores were ascertained by noting how many different points along a seven point continuum (obtained by assigning absolute values to the previously mentioned 13 point scale) were used by each subject in rating his acquaintances. A high-low score was also obtained by subtracting the subject's lowest rating on a given construct dimension from his highest rating on that same dimension. This value was then multiplied by the number of levels used to give the total ordination score for that construct. Ordination scores were averaged across all construct dimensions, thereby yielding an ordination score for that subject's constructs. An ordination score was also obtained for each element in the subject's system and this value was added to the ordination score for constructs to produce a total ordination score.

After finishing the ordination task, each subject was requested to take the 15 index cards, on which he had previously transcribed the names of his acquaintances, and place them in groups based on perceived shared similarity with regard to each construct dimension. The number of groupings used by the subject for each construct was recorded as the total NGS score (see Appendix E).

As a final part of the first experimental session, each subject was given Harvey's (1967) Conceptual Systems Test (see Appendix F). Procedures for this test called for the subject to indicate the extent of his agreement, or disagreement, with a number of general statements

about the world. This was done using a 6 point scale running from -3 to +3 with no zero point. As was the case for the second session, data were collected from subjects in small groups varying in size from one to five subjects. At this point in time subjects were reminded of their appointments for the second part of the experiment and sent home.

Session II

The second experimental session was primarily used to assess the subject's performance on the various dependent measures. Additionally, the test-retest reliability for three of the measures of integration used in this research was also determined. At the beginning of the second session each subject was reminded that he would be asked to try to solve some problem solving tasks which are similar to puzzles, as well as respond to a few more questionnaires. Order of presentation of the dependent measures was balanced across subjects in an attempt to control for any possible order effects. In all cases retest on the integration measures occurred only after assessment on all the dependent tasks had been completed.

Subject's preference for use of external vs internal descriptors was assessed using procedures similar to those employed by Schneier (1976). Each subject was presented with ten attributes which could potentially be used in rating teacher effectiveness (see Appendix G). He was then requested to indicate his preference for using these terms to rate previous teachers by determining an appropriate weight for each dimension. Extent of preference ranged from 1 to 10 with 10 being the highest. Mixed number weightings were also obtainable as the span

between whole numbers was divided into fifths. Five of the ten attributes provided on this form were selected because they appeared to meet Bieri, Bradburn, and Galinsky's (1958) criteria for external constructs. According to these authors, external constructs are typified by an "emphasis on the more apparent, superficial, and surface qualities of human behavior as contrasted with the more internal constructs which emphasized underlying motivation, emotional expression, and qualitative aspects of one's interpersonal relationship to another" (p. 3). Five attributes representing internal dispositions were also selected according to the definition provided by these researchers. The average weighting given to both the five internal attributes and the five external dimensions was computed for each subject and used as a dependent variable.

The measure of introversion-extroversion to be used in this study was based on the subject's responses to the Maudsley Personality Inventory developed by Eysenck. This form was administered using normal instructions and scored according to standard procedures. Another previously developed personality test was used to assess repression-sensitization. The 126 item revised Health and Opinion Questionnaire developed by Bryne, Barry, and Nelson (1963) was used for this purpose (see Appendix H). To respond to this inventory the subject merely indicated whether he agreed or disagreed with each of the 126 statements. His total score was calculated by summing the number of times a subject responded in the same manner as a sensitizer. Relatively high scores were seen as indicative of a tendency toward sensitization while relatively low scores were associated with repression.

The remaining two dependent measures were not questionnaires, but instead required the subject to solve some type of problem. The first of these was the Embedded Figures Test developed by Witkin (1950). Here subjects were asked to find simple geometric figures when embedded in more complex backgrounds. While this test was originally designed in two parallel sets of 12 figures apiece, not all of the figures of either set were used in this study because of time constraints. Instead of 12 or 24 figures, only 8 were used. The 8 chosen represented high, medium, and low levels of difficulty and were the same ones Bieri et al. (1958) found to correlate .98 with performance on the set of 12 figures. Witkin's notation for these figures, in order of their presentation, was F-1, D-2, A-5, G-2, E-5, B-1, C-1, and A-2. Figures were administered as described in the manual provided by Witkin, with the additional modification of a two minute time limit for the first seven figures and a four minute limit for the final figure. Additional instructions are included in Appendix I. The primary data obtained for this task were the lengths of time in seconds it took for each subject to find the simple embedded figure.

Measurement of efficiency of intuitive reasoning involved the use of reasoning problems developed by Wescott (1968) (see Appendix J). This test was introduced as a clue and problem type of puzzle where the task of the subject was to arrive at the correct solution to the problem while using as few clues as possible. The problems presented to each subject were of four types: verbal series problems, verbal analogy problems, numerical series problems, and numerical analogy problems. None of the problems required the use of any specialized knowledge. Problems were presented as a series of steps or clues which

were, initially at least, obscured from the subject by foil seals. The subject's job was to complete the series breaking as few seals and, thus, exposing as few clues as possible. In describing this task, the subjects were told that their solution must take into account the information which was unexposed. They were also told that they could attempt solutions without exposing any clues or could take as many clues as they wished in order. Scoring of performance on this task was based on what Wescott called efficiency which was simply the ratio of successes to the total number of clues used.

After finishing these tasks, all subjects were presented with the acquaintances they used in response to the Rep Test as well as the constructs they generated. One-third of these subjects were then asked to again apply their constructs by associating their acquaintances with one pole of each construct. Another third of the subjects were asked to again classify their acquaintances into groups in terms of their similarity on each construct dimension. The final third of the subjects were requested to once again rate each of their acquaintances on each of their construct dimensions so that test-retest reliability scores could be determined. Once this was accomplished, subjects were debriefed and any questions they had were answered.

CHAPTER III
RESULTS

As there were a disproportionate number of female subjects in this study, tests for sex differences on each of the measures were performed. It was hoped that scores for males and females could be combined for the analysis of variance tests of the various hypotheses. Results of these tests showed no significant differences between males and females except on the variables of intuitive reasoning and embedded figures. This finding justified the combining of data across the variable of sex for most of the analyses conducted in this study. The means, standard deviations, and intercorrelations for all of the measures used in this study are shown in Table 1. Contrary to expectation, one of the suggested measures of integration, the range of convenience (ROC) score, correlated .80 with the measure of differentiation (FIC). As this measure was highly related to differentiation, it will no longer be considered as a measure of integration, but for reasons which will be discussed later, will be considered as a possible alternative method for indexing differentiation. Another surprising finding was the lack of relationship between the three remaining measures of integration. Evidently the different assessment techniques were not measuring the same variable.

In an attempt to evaluate the predictions advanced in Hypotheses 1-4, the extent of relationship between all the predictor variables

Table 1
Means, Standard Deviations and Intercorrelation Matrix
for All Variables

Means and Standard Deviations

Variable	Mean	Standard Deviation
Functionally Independent Constructions (FIC)	16.325	7.401
Ordination (ORD)	53.299	9.317
Number of Groups used in Sorting (NGS)	47.214	15.287
Range of Convenience (ROC)	36.949	32.840
Conceptual Systems Test (CST)	2.248	9.701
Preference for Internal Descriptors (PID)	3.615	5.024
Intuitive Reasoning (IR)	.197	.070
Extroversion (EX)	29.923	8.841
Embedded Figures (EFT)	411.992	205.468
Repression-Sensitization (RS)	40.094	13.224

Intercorrelation Matrix

Variable	ORD	NGS	ROC	CST	PID	IR	EX	EFT	RS
FIC	.343	-.099	.799	.055	.087	.040	-.158	-.182	.023
ORD		.089	.259	.064	.046	.245	-.139	-.177	.135
NGS			-.098	-.076	-.018	.158	-.082	.050	.070
ROC				.075	.072	.039	-.082	-.189	-.058
CST					.058	.084	-.057	-.040	.103
PID						.146	-.253	-.199	-.047
IR							-.007	-.330	-.179
EX								.186	-.438
EFT									-.007

(i.e., FIC, ORD, NCR, ROC, and CST) and the various performance measures was computed using canonical correlation procedures. This type of statistical procedure determines the best possible relationship between two sets of variables. Using a SPSS computer program which determined the extent of relationship between the best possible linear combination of each of the two sets of variables, a canonical correlation coefficient of .40 was found. A test of significance using the Chi square approximation derived from the correlation coefficient yields a value of 41.34 with 35 degrees of freedom which fails to reach significance at the .05 level. Results of the canonical correlation analysis, including the weightings for each variable, are shown in Table 2. While not accounting for a significant proportion of the total variance in the performance measures, a tentative inspection of the weighting for each complexity variable suggests that perhaps the best single predictor may be ordination. The remaining variables all appear approximately equal in terms of their ability, or inability, to predict performance on the criterion variables. Additionally, the performance variable which appears to be most predictable is intuitive reasoning. Once again this interpretation must be guarded as the overall correlation was not significant.

A second approach to exploring the nature of the relationship between the predictor and criterion variables involved the use of a series of stepwise multiple regression analyses. All the measures of complexity used in this study were individually regressed on each of the performance measures. Results of these analyses are shown in Tables 3 through 7. As can be seen in Table 3, the regression of the complexity measures on the preference for use of internal descriptors

Table 2
Canonical Correlation of Complexity Variables
and Performance Measures

Canonical Correlation	.400
Chi-square	41.343
df	35
Significance	0.213

Variable	Canonical Coefficients
Set One: Functionally Independent Constructions	.454
Ordination	.696
Number of Groups used in Sorting	.350
Range of Convenience	-.430
Conceptual Systems Test	.448
Set Two: Preference for Internal Descriptors	-.015
Intuitive Reasoning	.406
Extroversion	-.194
Embedded Figures	-.003
Repression-Sensitization	.223

Table 3
Multiple Regression of Complexity Variables on Preference for use of Internal vs External Descriptors

Variable	B	Beta	Std Error	F-value	Multiple R
Functionally Independent Constructions	.054	.079	.068	.63	.087
Conceptual Systems Test	.027	.053	.049	.32	.102
Ordination	.008	.015	.054	.02	.103
Constant	2.235				

Multiple R^2 = .011

$F(3,113)$ = .407

Table 4
Multiple Regression of Complexity Measures on Intuitive Reasoning

Variable	B	Beta	Std Error	F-value	Multiple R
Ordination	.002	.238	.001	6.01*	.245
Number of Groups used in Sorting	.001	.139	.000	2.50	.280
Conceptual Systems Test	.001	.081	.001	.80	.291
Functionally Independent Constructions	-.000	-.033	.001	.11	.293
Constant	.075				

Multiple R^2 = .086 $p < .05$

$F(4,112)$ = 2.63*

clearly indicates no significant relationship as shown by a value of F (3, 113) = .41.

In contrast to this finding, the regression of the complexity measures on the variable of intuitive reasoning produces a multiple R of .29. This does represent a significant relationship as indicated by F (4, 112) = 2.63. This value is significant at the .05 level and it is, therefore, necessary to reject the null hypothesis that all the Beta weights representing the independent variables in the regression equation equal zero. Once a significant regression has been found, it is necessary to determine which of the independent variables are significantly related to intuitive reasoning. When stepwise regression is used and there is no inherent causal ordering between the independent variables, the significance of each independent variable is evaluated in terms of an F-ratio. In this test each variable is given credit only for its incremental contribution after all the other independent variables have been introduced into the equation. As can be seen in Table 4, the F values for NCS, CST, and FIC are not significant. These measures, then, do not uniquely contribute to the prediction of intuitive reasoning over the use of the other independent variables. The F-ratio for ordination is, however, significant. Since the simple correlation coefficient between ordination and intuitive reasoning is positive, it would appear that highly integrated individuals, as indicated by high ordination, tend to be better at solving problems by intuitive reasoning.

As can be seen in Tables 5 through 7, the regression of the complexity measures on the performance measures of extroversion, embedded figures, and repression-sensitization shows no significant relationships. Thus, there was no indication that performance on any of these

Table 5
Multiple Regression of Complexity Measures on Tendency towards Extroversion

Variable	B	Beta	Std Error	F-value	Multiple R
Functionally Independent Constructions	-.279	-.234	.190	2.17	.158
Number of Groups used in Sorting	-.052	-.090	.054	.92	.186
Ordination	-.074	-.078	.095	.61	.202
Range of Convenience	.032	.120	.042	.61	.213
Conceptual Systems Test	-.050	-.055	.085	.34	.220
Constant	39.810				

Multiple R^2 = .048

$F(5,111) = 1.13$

Table 6
Multiple Regression of Complexity Measures on
Repression-Sensitization

Variable	B	Beta	Std Error	F-value	Multiple R
Ordination	.180	.127	.141	1.61	.135
Range of Convenience	-.086	-.213	.062	1.91	.166
Conceptual Systems Test	.146	.107	.127	1.33	.194
Functionally Independent Constructions	.268	.150	.284	.90	.212
Number of Groups used in Sorting	.053	.061	.082	.42	.220
Constant	26.493				

Multiple R^2 = .048

$F(5,111) = 1.13$

Table 7
Multiple Regression of Complexity Measures on
Embedded Figures Task

Variable	B	Beta	Std Error	F-value	Multiple R
Range of Convenience	-.077	-.124	.968	.64	.189
Ordination	-3.040	-.138	2.189	1.93	.231
Number of Groups used in Sorting	.612	.046	1.261	.24	.236
Functionally Independent Constructions	-.835	-.030	4.389	.04	.237
Conceptual Systems Test	-.353	-.017	1.967	.03	.237
Constant	588.195				

Multiple R^2 = .056

$F(5,111) = 1.32$

variables could be predicted from any of these indices of cognitive complexity. The results of the individual multiple regressions were quite in line with those obtained in the canonical correlation analysis. Only one integration measure, ordination, was shown at all useful in predicting what the subject would do on any performance measures. Perhaps even more interesting was the fact that differentiation, as determined by the number of functionally independent constructions, was not, in these analyses, shown to be related to any of the dependent variables. This result is in definite opposition to that obtained by many other investigators in the field. It is possible, however, that the lack of positive results may have been caused by a restriction in the distribution on the cognitive complexity variable in the college population.

Although the distributions do not appear to differ markedly from normal, it is possible that a comparison of extreme groups, as defined by location on each of the complexity variables, will show the differences predicted in this study. Predictions for these types of analyses were specified in Hypotheses 5 through 9. To evaluate the data relating to each of these hypotheses, subjects were classified into groups on the basis of their performances on each of the proposed cognitive complexity measures. Subjects were classified as being high on differentiation if their FIC scores were greater than one-third of a standard deviation above the mean. Likewise, a subject was placed in the low differentiation category if his score was more than one-third of a standard deviation below the mean. This particular criterion was chosen because it only fails to classify a small proportion of the original sample, thereby leaving a fairly large subject pool for the

subsequent analyses. Similar type cutoff points (i.e., $\bar{x} \pm 1/3$ sd.) were also used to determine classifications for each of these proposed measures of integration: ORD, NGS, and CST. Using each of these integration classifications in conjunction with the subject's differentiation classifications, it was possible to classify about 70% of the original population into one of four groups. The four groupings, which were obtained by crossing the factors of differentiation and integration, were as follows: high differentiation-high integration (HH), low differentiation-high integration (LH), high differentiation-low integration(HL), and low differentiation-low integration (LL). Three different classifications based on the use of the three different measures of integration in conjunction with the FIC score were separately analyzed. Multivariate analysis of variance procedures were used to evaluate differences on all of the dependent measures simultaneously. The results of these tests are shown in Tables 8, 10, and 11.

Classification Based on FIC and ORD Scores

Table 8 shows the results obtained when FIC score is used as the measure of differentiation and ordination is used to index integration. The multivariate tests of significance, using *F*-ratio approximations based on Pillai's Trace Criterion, clearly demonstrates the existence of a significant interaction effect. Possible main effects for both integration (ORD) and differentiation (FIC) are also indicated. Since it has been determined that there are significant differences on at least one of the dependent measures, it is necessary to determine the source of these differences. One method of doing this involves looking at the univariate tests of significance for each of the dependent measures. These results are also presented in Table 8.

Table 8
Tests of Significance of Performance Measures for Subjects Classified in terms of Differentiation and Integration using Functionally Independent Constructions (FIC) and Ordination (ORD)

Means

Variable	High Diff. High Int.	Low Diff. High Int.	High Diff. Low Int.	Low Diff. Low Int.
Preference for Internal Descriptors (PID)	6.02	3.80	3.17	4.09
Intuitive Reasoning (IR)	.20	.22	.19	.18
Extroversion (EX)	26.20	27.90	31.30	32.80
Embedded Figures (EFT)	321.40	350.90	328.00	497.30
Repression-Sensitization (RS)	40.20	45.10	41.10	36.00
N =	25	18	13	26

Multivariate Tests of Significance using Pillai's Trace Criterion

Source	df	F	p less than
ORD	7.71	3.41	.004
FIC	7.71	1.92	.078
ORD X FIC	7.71	2.66	.017

Univariate Tests of Significance

Variable	Source	df	F	p	Variable	Source	df	F	p
PID	ORD	1,77	1.31	.256	EFT	ORD	1,77	9.00	.004
	FIC	1,77	.85	.360		FIC	1,77	9.23	.003
	ORD X FIC	1,77	.50	.481		ORD X FIC	1,77	.00	1.000
IR	ORD	1,77	3.16	.080	RS	ORD	1,77	2.19	.143
	FIC	1,77	.12	.720		FIC	1,77	.17	.690
	ORD X FIC	1,77	2.56	.110		ORD X FIC	1,77	1.35	.250
EX	ORD	1,77	9.09	.004					
	FIC	1,77	2.58	.112					
	ORD X FIC	1,77	.00	1.000					

Clearly the variables of repression-sensitization and preference for internal descriptors do not account for these differences as indicated by nonsignificant *F*-ratios. In contrast to this, the *F*-values for the variable of performance on the embedded figures do indicate significant differences. As was hypothesized, there was no interaction effect between differentiation and integration. There were, however, significant main effects for both of these variables. Since there were sex differences in the embedded figures task, a three-way analysis of variance was performed to see if the same results were obtained when sex was used as a third categorical variable. When this was done, the same type effects were found. Since there were significant differences for the classifications based on both differentiation and integration, it was important to look at the cell means to see if these differences were in the predicted direction. The mean scores for the Embedded Figures Test displayed in Table 8 represent the average number of seconds taken to solve all of the eight problems. For this reason, the lower the score the better the performance. Recalling Hypothesis 8, it was predicted that subjects high on both integration and differentiation would be the best at identifying embedded figures, while subjects low on both of these dimensions would do the worse. The results obtained conform exactly to this pattern. These results, then, provide the first demonstration of the utility of looking at cognitive complexity in terms of the dual processes of integration and differentiation.

In addition to differences in ease of identifying embedded figures, significant differences were also found on the variable of tendency toward extroversion. In this case, however, the only significant main effect was for ordination. Inspection of the means for this categorical

variable yield some unexpected results. Contrary to what was predicted on Hypothesis 7, it was the low integrated subjects who showed the most tendency toward extroversion. Highly integrated subjects seemed to respond to the Maudsley Personality Inventory in a relatively more introverted fashion.

While differences on the remaining dependent variable, intuitive reasoning, did not reach the .05 level of significance, there did appear to be some interesting trends in the data. A significant interaction between integration and differentiation had been predicted in Hypothesis 9 and the F-ratio of 2.56 obtained for this effect approaches statistical significance. Additionally, the pattern of means for intuitive reasoning is exactly as predicted. Low differentiating but highly integrating subjects, on the average, performed best on these problems, while the low differentiated and low integrated subject did the worst. In an effort to look more closely at this trend in the results, a re-analysis of the data was performed using only those subjects who had very extreme scores on the measures of integration and differentiation. To accomplish this end, only the 12 subjects most appropriately classified into each of the four cells were included in the analysis. Results of this analysis can be seen in Table 9. Although the multivariate tests for the extreme group do not show significant differences, it is again informative to look at tests on the univariate level. These results, however, must be interpreted with caution as the probability of making a Type II error with repeated univariate tests is increased. Keeping this reservation in mind, it is worth noting that there is a significant interaction between differentiation and integration on the variable of intuitive reasoning.

Table 9
Tests of Significance of Performance Measures for Extreme Groups of Subjects Classified in terms of Differentiation and Integration using Functionally Independent Constructions (FIC) and Ordination (ORD)

Means

Variable	High Diff. High Int.	Low Diff. High Int.	High Diff. Low Int.	Low Diff. Low Int.
Preference for Internal Descriptors (PID)	6.58	3.88	2.25	2.83
Intuitive Reasoning (IR)	.20	.24	.20	.16
Extroversion (EX)	23.80	27.80	32.00	33.20
Embedded Figures (EFT)	311.70	374.30	348.00	525.80
Repression-Sensitization (RS)	42.30	41.20	39.80	39.90
N =	12	12	12	12

Multivariate Tests of Significance using Pillai's Trace Criterion

Source	df	F	p less than
ORD	7,38	1.86	.105
FIC	7,38	1.79	.118
ORD X FIC	7,38	.87	.542

Univariate Tests of Significance

Variable	Source	df	F	p	Variable	Source	df	F	p
	ORD	1,44	1.95	.169		ORD	1,44	2.29	.137
PID	FIC	1,44	1.25	.270	EFT	FIC	1,44	5.52	.023
	ORD X FIC	1,44	.53	.471		ORD X FIC	1,44	1.49	.239
	ORD	1,44	4.51	.039		ORD	1,44	.17	.685
IR	FIC	1,44	.01	.917	RS	FIC	1,44	.02	.877
	ORD X FIC	1,44	4.11	.048		ORD X FIC	1,44	.00	.940
	ORD	1,44	6.05	.018					
EX	FIC	1,44	1.75	.193					
	ORD X FIC	1,44	.38	.539					

When the simple main effects are checked, using the means for each of the cells, the nature of the interaction appears exactly as predicted. There is an interaction between integration and differentiation such that, for the low differentiating individual, high system integration considerably enhances his ability to reason intuitively. Also as predicted, it is the person who is neither highly differentiated nor highly integrated who appears to have the greatest difficulty with this type of problem. In looking at the results for the other univariate tests, it becomes apparent that the pattern of results obtained using the larger sample has been altered very little. As before, there are no significant differences on the variables of repression-sensitization and preference for internal descriptors. Additionally, there is still a main effect for ordination with regard to extroversion tendencies and a main effect for FIC in relation to embedded figures performance. While the main effect for ordination on this latter variable is no longer significant, the absolute difference in cell means is even greater and is in the predicted direction. HH subjects appear even better on embedded figures and LL subjects even worse.

Classification Based on FIC and NGS Scores

Results of the multivariate analysis of variance using subjects classified on the basis of the number of groups they used in sorting stimulus elements (NGS) and their FIC score are shown in Table 10. The multivariate tests of significance for integration (NGS), differentiation (FIC), and their interaction reveal no differences for subjects classified by either of these two categorical variables. In general, no effect is seen for either type of complexity measure.

Table 10
Tests of Significance of Performance Measures for Subjects Classified in terms of Differentiation and Integration using Functionally Independent Constructions (FIC) and Number of Groups used in Sorting (NGS)

Means

Variable	High Diff. High Int.	Low Diff. High Int.	High Diff. Low Int.	Low Diff. Low Int.
Preference for Internal Descriptors (PID)	5.69	3.65	3.63	2.64
Intuitive Reasoning (IR)	.22	.21	.19	.17
Extroversion (EX)	28.20	29.90	29.20	32.20
Embedded Figures (EFT)	344.10	432.30	338.20	458.60
Repression-Sensitization (RS)	38.80	42.30	38.90	40.00
N =	14	23	23	24

Multivariate Tests of Significance Using Pillai's Trace Criterion

Source	df	F	p less than
NGS	7,72	1.41	.215
FIC	7,72	1.63	.141
NGS X FIC	7,72	.74	.644

Univariate Tests of Significance

Variable	Source	df	F	p	Variable	Source	df	F	p
	NGS	1,78	.74	.391		NGS	1,78	.10	.758
PID	FIC	1,78	.90	.345	EFT	FIC	1,78	5.28	.024
	NGS X FIC	1,78	.12	.726		NGS X FIC	1,78	.27	.606
	NGS	1,78	4.71	.033		NGS	1,78	1.42	.237
IR	FIC	1,78	.23	.634	RS	FIC	1,78	.08	.779
	NGS X FIC	1,78	.38	.541		NGS X FIC	1,78	.91	.344
	NGS	1,78	1.79	.185					
EX	FIC	1,78	1.05	.309					
	NGS X FIC	1,78	.25	.618					

Inspection of the univariate tests for each dependent measure confirm this finding as significant differences were found in only two cases. Once again these differences should only be interpreted with great caution as the more powerful multivariate tests indicate no significant differences. As was the case in the analysis which was performed using the subjects' ORD and FIC scores as a basis for classification, there is a significant effect for differentiation when embedded figure performance is considered as the dependent variable. Here again, good performance is found to be associated with high differentiation. This result clearly supports Witkin's (1969) conception of analytical ability as reflecting cognitive differentiation. A significant univariate effect for integration with regard to the dependent measure of intuitive reasoning can also be seen. This corroborates the results from the previous analyses. As had been predicted, high integration, whether indexed by the NGS score or ordination, appears to facilitate intuitive reasoning. Some support, then, has been found for each of these approaches to measuring integration. Thus far, however, ordination would appear to possess the greater potential utility since it was the only complexity measure found useful in predicting how the subject would do on any of the performance measures. Additionally, as the analysis using ORD in conjunction with FIC scores showed, ORD was useful in discriminating between the performance of subjects on the embedded figures task and in terms of their tendency toward extroversion.

An analysis using only those subjects with extremely high or low scores on the FIC and NGS measures was also performed. The results of this analysis did not, however, differ much for the results obtained

using the larger sample. There were still no significant multivariate differences, and there was still a significant univariate effect for differentiation in relation to embedded figure performance. Two more significant differences did appear on the univariate level. Main effects for integration (NGS) were obtained on both the variables of extroversion, F (1, 42) = 5.48, $p < .05$, and preference for the use of internal descriptors, F (1, 42) = 4.40, $p < .05$. The first of these results confirms the earlier finding that highly integrated subjects appear relatively more introverted than less integrated individuals. The second finding provides some tentative support for at least a portion of Hypothesis 5, as persons possessing highly integrated cognitive systems showed a marked preference for internal descriptors. Both of these findings would seem to provide at least minimal support for the use of the subject's NGS score as a measure of integration.

Classification Based on FIC and CST Scores

A summary of the multivariate analysis which was performed using classification based on the subjects' FIC and CST scores is shown in Table 11. As can be readily surmized, the multivariate tests reveal no significant differences between any of the different groups. This point is further supported by the fact that none of the separate univariate tests indicate the presence of any significant differences. Only two of the univariate tests even approach significance and both of these involve the use of the differentiation measure, FIC scores. These two effects for differentiation, which are seen in connection with embedded figures performance and tendency toward extroversion, simply reflect the differences on these tasks that were discussed earlier.

Table 11
Tests of Significance of Performance Measures for Subjects Classified in terms of Differentiation and Integration using Functionally Independent Constructions (FIC) and Conceptual Systems Test (CST)

Means

Variable	High Diff. High Int.	Low Diff. High Int.	High Diff. Low Int.	Low Diff. Low Int.
Preference for Internal Descriptors (PID)	5.18	5.00	4.00	3.07
Intuitive Reasoning (IR)	.20	.18	.19	.19
Extroversion (EX)	27.50	29.40	24.70	31.80
Embedded Figures (EFT)	361.70	413.90	332.30	461.10
Repression-Sensitization (RS)	39.50	41.10	41.50	38.20
N =	24	20	15	28

Multivariate Tests of Significance Using Pillai's Trace Criterion

Source	df	F	p less than
CST	7,75	1.19	.321
FIC	7,75	1.08	.385
CST X FIC	7,75	.60	.752

Univariate Tests of Significance

Variable	Source	df	F	p	Variable	Source	df	F	p
	CST	1,81	2.18	.144		CST	1,81	.72	.400
PID	FIC	1,81	.22	.638	EFT	FIC	1,81	3.26	.075
	CST X FIC	1,81	.00	1.000		CST X FIC	1,81	.41	.525
	CST	1,81	.03	.872		CST	1,81	.14	.707
IR	FIC	1,81	.13	.717	RS	FIC	1,81	.05	.820
	CST X FIC	1,81	.16	.690		CST X FIC	1,81	1.66	.202
	CST	1,81	.94	.335					
EX	FIC	1,81	3.23	.076					
	CST X FIC	1,81	1.24	.269					

A re-analysis based on these same classifications using only the 48 subjects with the most extreme scores, revealed no additional relationships. On the basis of both of these analyses and also the multiple regression analyses conducted earlier, it is clearly evident that the Cognitive Systems Test was unrelated to performance on any of the dependent measures included in this study.

Classifications Based on ROC and ORD Scores

As it was originally presented, the subject's range of convenience score (ROC) was suggested as a possible means for measuring system integration. Preliminary analysis of the data, however, indicated that this score was highly correlated with the FIC measurement of differentiation, r = .80. Since these two dimensions are obviously not orthogonal, an analysis based on separate classifications on each of these dimensions is clearly not appropriate.

While the existence of such similarity between these two variables was quite unexpected, in retrospect it can be quite easily understood. The determination of the number of functionally independent constructions used by each subject was based on comparing how the subject sorted each of the stimulus elements on each of the construct dimensions generated by the Rep Grid procedures. Two constructs were judged functionally the same if the subject classified 12 or more of the 15 stimulus figures in the same way with regard to the two poles of each construct dimension. Basically the greater the number of constructs judged similar by this method the lower the number of functionally independent constructions and, thus, the lower the extent of differentiation evidenced by the subject. When a subject tends to classify the

majority of the stimulus elements with one of the two poles of a construct dimension there is about a .5 chance that the same element will be classified on the same side of another construct dimention. If a subject associates most of the elements on the Rep Grid with one side or the other of a construct dimension, then, on the average, there should be about seven matches occurring due to chance alone when any two construct dimensions are compared. When, however, a subject chooses to not classify a large proportion of the elements, but instead indicates that a given construct dimension does not apply to a given element, he is introducing a third classification category. The use of three categories as opposed to two decreases the probability of a given element being classified in the same way on different dimensions. The average number of matches between any two construct dimensions when the not applicable category is used extensively is, therefore, also reduced. This reduction in the average number of matches between any pair of construct dimensions will also decrease the probability that the two dimensions will be judged functionally equivalent. This, in turn, should lead to an increase in the number of functionally independent constructions, thereby indicating greater differentiation. For this reason, the greater the number of times a subject refuses to classify an element with one side of a construct dimension (i.e., the greater the ROC score) the greater the likelihood that he will obtain a high FIC score.

Since these two measures are so highly related, it is possible that the subject's ROC score may represent an alternative to the use of FIC scores for measuring differentiation. To test the plausibility of this assumption, the subject's ROC score was considered as a measure

of differentiation, and subjects were classified into high and low differentiation groups on the basis of this variable. The same analysis of variance model as discussed earlier was used again with the NGS and ORD scores serving as the measures of integration. The CST score was not used given the earlier findings showing no relationship between this variable and any of the dependent measures.

Results of the analysis using ROC as the index of differentiation and ORD as the measure of integration are displayed in Table 12. Looking at these results it is readily apparent that the multivariate tests of significance indicate the presence of a significant interaction effect for the ordination and range of convenience scores as well as a possible simple main effect for ordination. Glancing over the summary of the univariate tests for significance, it becomes clear that the interaction effect for differentiation and integration is probably a result of differences in intuitive reasoning between the four classification groups. While an interaction effect was hypothesized between differentiation and integration with regard to this variable, inspection of the means for the different groups reveal differences which are not in the predicted direction. Subjects in the HH category appear to show the greatest intuitive reasoning ability. Subjects classified in the LL group, instead of showing the least ability to solve the intuitive reasoning problems, were found to be the second best at these sorts of problems.

While these findings definitely run counter to predictions, a reanalysis of the data using the variable of sex as a separate factor revealed the source of the differences. A disproportionate number of females were found in HL and LH categories while the majority of the

Table 12
Tests of Significance of Performance Measures for Subjects Classified in terms of Differentiation and Integration using Range of Convenience (ROC) and Ordination (ORD)

Means

Variable	High Diff. High Int.	Low Diff. High Int.	High Diff. Low Int.	Low Diff. Low Int.
Preference for Internal Descriptors (PID)	4.71	6.08	3.81	3.33
Intuitive Reasoning (IR)	.24	.19	.18	.21
Extroversion (EX)	30.50	23.80	32.80	31.90
Embedded Figures (EFT)	381.10	369.00	466.20	345.20
Repression-Sensitization (RS)	42.30	41.70	34.70	40.30
N =	16	20	24	12

Multivariate Tests of Significance using Pillai's Trace Criterion

Source	df	F	p less than
ROC	7,62	1.12	.362
ORD	7,62	2.16	.050
ROC X ORD	7,62	2.48	.026

Univariate Tests of Significance

Variable	Source	df	F	p	Variable	Source	df	F	p
PID	ROC	1,68	.39	.536	EFT	ROC	1,68	3.69	.058
	ORD	1,68	1.92	.170		ORD	1,68	1.96	.166
	ROC X ORD	1,68	.08	.777		ROC X ORD	1,68	.23	.636
IR	ROC	1,68	.00	.953	RS	ROC	1,68	.84	.362
	ORD	1,68	3.17	.080		ORD	1,68	2.62	.110
	ROC X ORD	1,68	6.40	.014		ROC X ORD	1,68	.13	.716
EX	ROC	1,68	3.50	.066					
	ORD	1,68	6.56	.013					
	ROC X ORD	1,68	.00	1.000					

males were found in the HH and LL groups. Differences in the sexual make-up of these groups resulted in different mean scores for the different classifications. Thus, when sex was included as a third variable in the analysis the interaction effect between ROC and ORD vanished. Using this same type of analysis, it was discovered that the significant univariate main effect for ROC, with regard to performance on the embedded figures task, was also produced by the same sexual imbalance. There was no difference between groups classified on the basis of ordination in terms of their ability to find embedded figures once the effect for sex was removed.

Since the differences seen in relation to the dependent variables of embedded figures and intuitive reasoning were found to be artifactual, the only significant difference between groups classified on the basis of ROC and ORD scores occurs in relation to the subject's extroversion score. In results which replicate findings discussed earlier, subjects low in system integration were found to be more extroverted than subjects who possessed more integrated cognitive systems. This result, however, was not found when groups were composed solely of subjects with extreme ROC and ORD scores. When these qualifications are considered, it would appear that classifications based on the subject's ROC and ORD scores were not very successful in discriminating between individuals in terms of their performance on the various dependent measures.

Classifications Based on ROC and NGS Scores

A final analysis was conducted in this study using subjects classified on the basis of their ROC (for differentiation) and NGS (for

Table 13
Tests of Significance of Performance Measures for Subjects Classified in terms of Differentiation and Integration using Range of Convenience (ROC) and Number of Groups used in Sorting (NGS)

Means

Variable	High Diff. High Int.	Low Diff. High Int.	High Diff. Low Int.	Low Diff. Low Int.
Preference for Internal Descriptors (PID)	4.07	5.65	3.15	3.15
Intuitive Reasoning (IR)	.22	.22	.16	.20
Extroversion (EX)	30.50	27.80	32.40	32.60
Embedded Figures (EFT)	414.80	387.70	451.10	334.50
Repression-Sensitization (RS)	40.30	37.60	39.20	39.40
N	19	13	27	17

Multivariate Tests of Significance Using Pillai's Trace Criterion

Source	df	F	p less than
ROC	7,64	.69	.681
NGS	7,64	1.49	.185
ROC X NGS	7,64	1.81	.101

Univariate Tests of Significance

Variable	Source	df	F	p	Variable	Source	df	F	p
	ROC	1,70	.22	.642		ROC	1,70	2.05	.157
PID	NGS	1,70	1.80	.184	EFT	NGS	1,70	.03	.853
	ROC X NGS	1,70	.30	.584		ROC X NGS	1,70	1.10	.298
	ROC	1,70	.75	.391		ROC	1,70	.04	.847
IR	NGS	1,70	6.25	.015	RS	NGS	1,70	.05	.827
	ROC X NGS	1,70	.77	.384		ROC X NGS	1,70	.43	.515
	ROC	1,70	1.01	.319					
EX	NGS	1,70	1.82	.182					
	ROC X NGS	1,70	.00	1.00					

integration) scores. The results of this analysis can be seen in Table 13. Even a quick glance at the multivariate tests of significance indicates that there are no differences, in terms of performance on the five criteria measures, between the four groups of subjects. These results are further supported by the existence of only one significant main effect on the univariate level. The sole significant univariate main effect is for NGS in relation to intuitive reasoning. This finding verifies the results obtained in the analysis using classifications based on NGS and FIC scores. Highly integrated subjects were found to do better on intuitive reasoning problems than subjects evidencing little system integration. When an analysis was performed using only those subjects scoring in the extreme ranges on both the ROC and NGS indices, exactly the same pattern of results was obtained.

CHAPTER IV
DISCUSSION

On the basis of the results discussed in the previous section, it is clear that there is little support for the predictions advanced in Hypotheses 1 through 3. In terms of the analyses based on multiple regression procedures, there is no evidence for the idea that measures of integration and differentiation will both be useful in predicting performance on any of the dependent tasks. Indeed, only one measure of complexity, ordination, showed any utility whatsoever in predicting any of the subject's behavior. Given this lack of positive results, the question arises whether the three tentative measures of integration, as well as the two measures of differentiation, were at all successful in fulfilling their purpose. Contrary to expectations, none of the three measures of integration correlated significantly with each other; a fact which raises doubts about whether they are indexing the same or even similar qualities. Since ordination was the only measure to be at all useful in predicting subject's performance and since neither NGS nor CST were related to the ordination, it might be reasonable to conclude that of all the measures proposed to guage integration only ordination offers any real possibilities. In fact, if only one index of complexity is to be used, the results here indicated that the measure chosen should be ordination.

Another particularly surprising finding was that the CST score failed to correlate not only with the other measures of integration but also with the differentiation measure. Even more damaging to its credibility, however, was the fact that it showed virtually no relationship with any of the performance tasks. Evidently the Conceptual Systems Test is not quite as good a general measure of cognitive structure as Harvey (1967) suggests. Even though the subject's score on the Conceptual Systems Test was not found to be a sufficient way of appraising cognitive complexity neither were most of the other proposed measures of cognitive structure. The sole exception to this was, of course, ordination. However, relying on a single method of assessing complexity may have limited utility as additional results indicate that a two process approach, with separate measures of differentiation and integration, may be more satisfactory.

Evidence for the Two Process Approach to Cognitive Complexity

Actually the value of the two process approach is not evident from the analysis based on multiple regression techniques. The importance of this approach only becomes apparent in terms of the ability of the separate measures to classify subjects into distinct groups with regard to perfromance on the various dependent variables. Only two of the various complexity measures included in this study showed any potential for accomplishing this goal. This success was evidenced in the classifications based on FIC and ORD scores. When the results of the multivariate analysis of variance using only those subjects with extreme scores was also considered, classifications based on scores on the FIC and ORD measures resulted in significant differences on three of the

five dependent variables. Perhaps more importantly these differences, with the exception of the extroversion score, were all in the predicted direction. Even the predicted interaction between differentiation and integration was found for intuitive reasoning. The value of the two process approach to complexity was further demonstrated by significant main effects for each of the subprocesses. If differentiation, as measured by the subject's FIC score, had been used as the sole measure of complexity, the nature of the relationship between cognitive complexity and skill at uncovering embedded figures would not have been clarified. Obviously lack of system integration as well as differentiation impedes performance in this type of task. Furthermore, it is the person who possesses both high integration as well as high differentiation who is best at this sort of endeavor. In terms of the subject's preference for the use of internal or external adjectives in describing the behavior of others, if differentiation were the only aspect of complexity being considered, no difference with regard to this variable would have been found. The same thing is also true with respect to intuitive reasoning. Without considering the subprocess of integration no relationship between the ability to solve problems intuitively and cognitive complexity would have been noticed.

While the results of this study indicate that integration is a necessary component of complexity, the findings also point to the idea that measurement of integration alone is not a sufficient way of defining complexity. If the differentiation aspect of complexity had been neglected, then the relationships between complexity and performance on both the embedded figures and intuitive reasoning tasks would have been much less clear. Certainly these results suggest that any attempts

at trying to understand or measure cognitive complexity must concern themselves with the subprocesses of differentiation and integration. This conclusion must, however, be qualified by the fact that neither of the proposed differentiation measures added significantly to the variance accounted for by the ordination score alone in predicting any of the dependent measures.

A Comparison of Measures of Differentiation

In considering the question of which of the two measures of differentiation (i.e., FIC or ROC) has the greatest inherent potential, it is necessary to look at the results of classification based on both of these measures. In doing this, it is apparent that only one multivariate analysis, besides that based on ORD and FIC scores, showed significant differences. This was the classification determined by ROC and ORD scores. Obviously the results obtained here should be similar to those found using the FIC and ORD measures. Both classifications are similar in the use of the ordination measure, and as mentioned earlier, there was a highly significant correlation between the ROC and FIC measures. Even so, the results of this second analysis were not as clear-cut as those obtained using the FIC and ORD scores. The significant univeriate effects seen for the dependent variables of embedded figure performance and intuitive reasoning were artifactual and vanished when the additional factor of sex was considered. The remaining significant univariate effect occurred for ordination on the dependent variable of extroversion. This finding replicated the difference found for ordination in the first multivariate analysis of variance. As such, it would seem to provide additional support for

validity of this method for measuring integration. Given the lack of any other significant effects, the inference might be made that the ROC score was not as adequate a method of measuring differentiation as the FIC score. This conclusion is further supported by the lack of any significant differences between groups of subjects categorized on the basis of their ROC and NGS scores. In this latter analysis not only do the multivariate tests fail to show significant differences but there are also no significant differences for ROC on the univariate level. This finding is particularly important in view of the fact that the ROC score is highly correlated with FIC score, while being much easier to score. Determining the FIC score for a given subject requires about 45 minutes, while the range of convenience score can be computed in far less time. Nevertheless, ROC fails to pass the critical test for all psychological measures as only the FIC score has demonstrated validity. Additional evidence supporting the usefulness of FIC scores as a measure of differentiation can be seen with classifications based on FIC and NGS scores. Although there were no significant multivariate effects, there was a significant univariate effect for FIC with respect to the subject's ability to identify embedded figures. Subjects considered differentiated by Witkin's (1969) definition of this term also tended to have high FIC scores. Although the effect was not seen in the complete analysis using FIC and CST scores, there was a trend in this direction ($p < .08$) when subjects with extreme scores were considered. There would, therefore, appear to be at least some indication that the FIC score is the best measure of differentiation.

NGS as a Measure of Integration

Although all the results in this study point to the usefulness of ordination as a way of assessing cognitive structure, there is at least minimal evidence suggesting that the NGS score may represent an alternative method for assessing system integration. In the analysis of subjects classified in terms of their FIC and NGS scores, while there were no significant multivariate effects, there was a significant main effect for NGS on the univariate level. Subjects with high NGS scores were significantly better at intuitive reasoning problems than subjects with low scores. This same effect was also found in the analysis using subjects categorized by their ROC and NGS scores. Both these findings are consistent with predictions since highly integrated subjects presumably will be more adept at problem solving by analogy.

Besides these results, which can only be tentatively interpreted because of the finding of no significant multivariate effects, there were perhaps a couple of additional indications of the utility of the NGS score. When only subjects with extreme scores on the FIC and NGS measures were considered two additional univariate effects for NGS appeared significant. In terms of the variable of extroversion, subjects with high NGS scores tend to be more extroverted than subjects who obtained low scores. F (1, 44) = 5.48, $p < .02$. This finding is interesting in that, while it is in line with predictions made in Hypothesis 6, it was counter to the findings obtained when ordination was used as the measure of integration. Even so, the weight of the evidence appears to be on the side of ordination as the most useful measure of system integration. Certainly Harvey's Conceptual Systems

Test was not very productive in this regard, at least in terms of variables included in this study.

Performance Measures as They Relate to Cognitive Complexity

Quite obviously the results obtained in this study support several of the predictions made in Hypotheses 5 through 9 and refute several others. Possible post hoc explanations for the predictive failures can be easily advanced. In the case of the expectations put forth in Hypothesis 5 concerning the proposed relationship between cognitive complexity and preference for internal descriptors, one particular problem could have led to the negative results. Before discussing this problem it is worth mentioning that, while the effects for differentiation and integration were not significant, the pattern of means in the cells of the classification based on ORD and FIC scores was as predicted. As presented in Table 8, subjects in the HH condition were almost twice as likely to prefer to use internal descriptors in rating teachers as subjects in the other cells. The absolute magnitude of this difference was even greater when only subjects at the extremes of each variable were included in this analysis. This same pattern of means was also found in classifications based on FIC and NGS scores. Even in the classification based on FIC and CST scores, HH subjects showed greatest preference for internal descriptors.

In speculating as to why the obtained differences did not approach statistical significance, the most obvious explanation centers on the fact that there was a tendency across all subjects in this study to prefer to use internal descriptors. While this occurrence might reflect

the fact that college students tend to be more complex than the general population, it is also possible that this finding was obtained for another reason. Several of the subjects who took part in this experiment mentioned during the debriefing period that they were education majors, and to their minds, it was quite evident that several of the descriptors included on the Teacher Rating Form were more important than the others. As might be guessed, each of the terms they felt were the most important were classified as internal descriptors. It was their contention that their training in education taught them to weigh internal qualities more heavily than external ones in judging teachers' performance. Since these subjects had a built-in bias for internal descriptors, it is also possible that college students in general have come to value these same types of attributes in teachers, owing to their own typically extensive experience with higher education. In other words, there may be a general stereotype among college students concerning just what qualities are to be found in a good teacher. The existence of this sort of stereotype may have decreased the range of preference scores by making it less likely that a subject would show a preference for an external descriptor. This, in turn, may have reduced the magnitude of preference differences between groups of subjects differing in terms of complexity. To the extent that this type of situation did exist, a fair test of the relationship between cognitive complexity and preference for the use of internal descriptors was not conducted.

A second variable, repression-sensitization, was also found to be unrelated to cognitive complexity as it was assessed in this study. While these results would seem to run counter to the findings of

Wilkins, Epting and Van de Riet (1972), it should be mentioned that these same investigators found no relationship between these two variables when using Bieri's (1955) method of determining differentiation. In this regard, it should be mentioned that the differentiation measure used in this study (FIC) was conceptually much closer to Bieri's (1955) method of assessing complexity than Bieri et al.'s (1966) method, which Wilkins et al. found to be related to repression-sensitization. In contrast to his earlier approach, Bieri et al.'s (1966) method of assessing differentiation was based on the use of provided rather than elicited constructs. Since assessment techniques based on the use of provided constructs are quite different from methods using elicited constructs, it is perhaps wise to consider the failure to find a significant relationship between cognitive complexity and the subject's characteristic mode of responding to threatening stimuli a product of the use of this particular assessment technique. The question of whether the FIC score or a measurement strategy based on Bieri et al.'s (1966) methodology represents the most sufficient procedure for indexing differentiation was not addressed in this study. In any case, there were not even any trends in the data which would suggest the existence of a relationship between repression-sensitization and the complexity variables which were included in this research.

The subject's tendency to respond to certain statements in the manner typical of an extrovert was a third variable used in this study for which the results did not conform to predictions. Although a significant main effect for integration, as measured by ordination, was found for this variable, no effect was found for either of the differentiation indices. Additionally, the obtained effect for

integration was in the opposite direction to that which had been predicted. Highly integrated individuals were more likely to be introverts than extroverts. Fortunately this finding readily lends itself to a post hoc explanation. In the first place, even though there were good theoretical reasons for expecting individuals high in complexity to be extroverts (Crockett, 1965), there was little empirical evidence actually supporting this proposed relationship. The only findings really supporting this notion were those of Bieri and Messerley (1957) using an unusual measure of extroversion, content scoring of the Rorschach. Given the state of affairs that often exits in psychology where two measures purporting to measure the same underlying dimension are uncorrelated, it was perhaps unreasonable to expect to replicate the findings of Bieri and Messerley. This problem may have been exacerbated by the fact that the current study used both a different measure of extroversion as well as different porcedures for assessing cognitive complexity.

With the indices of complexity that were used in this research, it was generally found that the subject with high system integration was more likely to have introverted rather than extroverted tendencies. Differentiation, however, bore no relationship whatsoever with either introversion or extroversion. This finding, however, is not that surprising. On intuitive grounds, it might be reasonable to assume that the introvert is the type of person who is more likely to be introspective about his relations to others. To the extent that this is true, this sort of individual might develop a more integrative cognitive structure. The question of whether this notion of

the relationship between extroversion and complexity or that advanced by Crockett is the most correct can only be answered through additional research.

With respect to the two remaining dependent variables that were used in this investigation, differences of the type predicted in Hypotheses 8 and 9 were found. In terms of Hypothesis 8, which addressed the relationship between complexity and performance on the embedded figures test, differentiation as measured by the subject's FIC score was consistently related to the ability to find the hidden figures. Highly differentiated individuals were better at this sort of task than subjects possessing relatively undifferentiated systems. Additionally, when ORD was used as the method for ascertaining the extent of integration, there was a significant relationship between integration and skill in uncovering embedded figures. Thus, there was strong evidence suggesting that the capacity to function in either an analytical or global manner is related to both aspects of the individual's cognitive system. In terms of the final dependent variable, intuitive reasoning, the relationship with complexity was more or less as predicted. Although this ability was primarily related to integration, there was some indication that proficiency at these sorts of problems was also effected by the extent of differentiation.

When all the qualifications discussed above are taken into account, there generally seems to be at least minimal evidence suggesting that all of the dependent variables used in this study, with the possible exception of repression-sensitization, are related to one or the other aspects of cognitive complexity.

The Generalizability of Cognitive Complexity

The question of the generality of cognitive complexity, when measured in terms of both integration and differentiation, was addressed in Hypothesis 4. There it had been speculated that interpersonal complexity would be most related to the dependent variables reflecting interpersonal processes and moderately related to variables drawn from other content areas. This latter supposition was substantiated, but surprisingly the former was not. As suggested earlier, the failure to find greater relationship between complexity and preference for internal descriptors may be a product of the inappropriateness of the nature of the task (i.e., rating teacher performance) to the population under study. To the extent that this was the case, the results for this dependent variable may be discounted and the remaining findings might be interpreted as supporting the idea of cognitive complexity as a general individual difference dimension. Subjects who were highly differentiated interpersonally tended to be more analytical, and persons who were highly integrated were good at reasoning by analogy on problems of various types. No relationship, however, was found between any measure of complexity and the subject's typical mode of responding to threatening stimuli. Even so, when the data from this research are added to the findings supplied through other studies in the field (e.g., Allard and Carlson, 1963, and Epting, 1967), the weight of the evidence would appear to suggest the existence of some generalizability for cognitive complexity. On the basis of these results, it is probably safe to conclude that there is a tendency for the person who is complex with regard to one content area to be complex in other fields, given the opportunity for experience in that field.

Methodological Observations

While a good deal has been made of the findings obtained by using analyses based on multivariate analysis of variance procedures, it is sobering to remember that none of the various measures of complexity did a very good job of predicting the subject's performance on any of the tasks used in this study. These measures were simply less than successful in accounting for the behavior of the subjects. This failure cannot help but raise doubts concerning the sufficiency of the measures of complexity included in this research. These doubts, unfortunately, are only heightened when the test-retest reliability of these measures is considered.

While test-retest reliability of the FIC score was not determined in this study, suggestions from another source are less than encouraging. Although Bieri (1955) reports a .80 test-retest coefficient, Bavelas, Chan, and Guthrie (1976) found only a low retest reliability coefficient for Bieri's (1955) method. While this index of differentiation is not strictly equivalent to the FIC measure developed by Landfield (1971), it is in many ways analogous and might be expected to possess an even higher degree of reliability. Differentiation as guaged by the number of functionally independent constructions allows subjects to use a non-applicable or indeterminate category in sorting stimulus elements. Subjects, however, do not tend to make use of this additional category in a particularly reliable fashion as indicated by a test-retest coefficient of .71 for the range of convenience score. Additionally, the ROC score was found to be highly correlated with the FIC measure of differentiation. For this reason, it is doubtful

that the reliability for the FIC score exceeds that of Bieri's original instrument.

Although the reliability of Landfield's measurement of differentiation was not assessed in this study, actual data were collected bearing on the reliability of three of the other proposed indices of complexity. In addition to the reliability coefficient for ROC just mentioned, estimates of test-retest reliability for ordination and the NGS score were also computed. The test-retest reliability for NGS was an acceptable .84. For ordination, however, the coefficient was only .48. Obviously none of these measures of complexity, with the possible exception of the NGS score, has demonstrated a great deal of reliability. This, in turn, may have served to limit the indications of validity obtained for the various methods of assessing complexity included in this study.

Even while advancing this idea, it should also be mentioned that the estimates of test-retest reliability acquired in the course of this investigation may be artifically low due to possible fatigue and reduced incentive on the part of subjects. Information used in computing the test-retest coefficients was the last thing gathered from each subject. This data was accrued after the subjects had completed a second relatively boring two-hour session. By this point in time, most subjects were fairly drained and few were very receptive to the idea of repeating a task they had completed in the first session. Many subjects reflected this state of affairs in the hasty manner in which they completed their final tasks. Estimates of test-retest reliability may, therefore, have been lower than they should have been.

Because of the relatively low reliability coefficients and the limited demonstrations of validity for each of the complexity instruments,

there is good reason to doubt the sufficiency of these measures of cognitive complexity. However, just because the particular techniques used for assessing complexity in this study have met with only guarded success, it should not necessarily be assumed that the measurement of cognitive complexity is itself a worthless enterprise. A more appropriate conclusion might be that it is the assessment instruments which need to be refined, rather than the theory which needs to be reconceptualized. Certainly it still seems reasonable to assume that there are differences in the structure of the ways individuals have of construing the world which, in turn, effect how they behave.

In proposing that future efforts in the field of complexity be concerned with developing more adequate measurement techniques a few observations made in connection with the current methods should be considered. Each technique used for assessing complexity in this research, with the sole exception of the Conceptual Systems Test, demanded a great deal of time from both the subject and the investigator. Subjects generally agreed that the two hours they spent filling out the assessment instruments were boring and something they wish they could have avoided. Given this lack of enthusiasm on the part of the subjects, questions arise concerning the subject's motivation for responding to these instruments in a truly representative manner. For this reason, perhaps the low reliability and the limited validity found for these assessment procedures is at least partially a product of the subject's reaction to the task he had been requested to perform.

In addition to the effort demanded from the subject by each of thse complexity instruments, the researcher wishing to use these techniques must be willing to devote a great deal of his time to the

exceedingly repetitive and boring task of scoring the various measures. The determination of just the number of functionally independent constructions used by a single subject involved about 45 minutes of the researcher's time. Measurement of ordination also took about 30 minutes per subject so that scoring both aspects of cognitive complexity is a very time consuming undertaking. Actually, it is the opinion of this investigator that the cost of using the current procedures for assessing complexity for applied problems far outweighs their demonstrated utility. Current techniques may, however, be useful in addressing theoretical questions.

In conclusion, there are several recommendations which should be considered when attempting to develop new ways of measuring cognitive complexity. First of all, as this study clearly points out, any method of measuring complexity should be based upon a conception of complexity which includes the dual processes of differentiation and integration. Additionally, many potential complications might be avoided if new measurement techniques are developed which are both more reliable and more interesting to the subject.

Summary

Nine principal hypotheses were advanced in this study of which most were at least partially confirmed. Limited evidence was obtained suggesting that cognitive complexity is really a general term which should include the subprocesses of both differentiation and integration. Comparisons of the different measures of integration and differentiation produced more interpretable results. Ordination was definitely the best measure of integration while Landfield's other measure, based

on the number of functionally independent constructions, appeared to be the best index of differentiation. Unfortunately the FIC measure was not directly compared to other differentiation measures previously developed so the possibility exists that these methods (e.g., Bieri et al, 1966; Crockett, 1965) may be more useful. In total, little evidence of convergent validity was found since there was no correlation between the different measures of integration. Some evidence of divergent validity was obtained since both integration and differentiation were found to be related to different aspects of the subject's behavior. Unfortunately, little evidence was obtained for predictive validity since only one measure, ordination, could be used to predict performance on any of the dependent variables.

Some support for the generality of cognitive complexity was shown as interpersonal complexity was found to be related to the subject's ability to find embedded figures and to reason intuitively. Surprisingly, however, interpersonal complexity showed only minimal relationship to the interpersonal dependent variables included in this study.

Finally, in interpreting the results of this research, it was speculated that further work in this field should be addressed to developing new methods of assessing cognitive complexity. On the basis of these results, it was concluded that new assessment techniques should not only take into account the dual processes of integration and differentiation but should try to avoid some of the methodological problems currently afflicting this type of endeavor.

APPENDICES

APPENDIX A
ROLE SPECIFICATION SHEET

1. Write the first name of your mother or the person who has played the part of your mother, on the first diagonal line on the Response Sheet (after number one).

2. Write the first name of your father or the person who has played the part of your father on the second diagonal.
   Do the best you can to find people who fit the types listed. If you have to depart too far from the type designated in order to fill every diagonal, star those names which do not fit very well.

3. Write the name of your brother nearest your own age, or the person who has played the part of such a brother.

4. Write the name of your sister nearest your own age, or the person who has played the part of such a sister.

5. Your wife (or husband) or closest present girl (boy) friend. Do not repeat the name of anyone listed above.

6. Your closest present friend of the same sex as yourself. Do not repeat names.

7. A person with whom you have worked or associated who, for some unexplainable reason, appeared to dislike you. Do not repeat names.

8. The person with whom you usually feel most uncomfortable. Do not repeat names.

9. The person whom you have met who you would most like to know better.

10. The teacher whose point of view you have found most acceptable. Do not repeat names.

11. The teacher whose point of view you have found most objectionable. Do not repeat names.

12. The most unsuccessful person whom you know personally. Do not repeat names.

13. The most successful person whom you know personally. Do not repeat names.

14. The happiest person whom you know personally. Do not repeat names.

15. The unhappiest person whom you know personally. Do not repeat names.

Appendix B
Response Sheet-Role Construct Repertory Grid

Column 1 Construct	Number of Groups	Column 2 Constrast
1 _____	_____	1 _____
2 _____	_____	2 _____
3 _____	_____	3 _____
4 _____	_____	4 _____
5 _____	_____	5 _____
6 _____	_____	6 _____
7 _____	_____	7 _____
8 _____	_____	8 _____
9 _____	_____	9 _____
10 _____	_____	10 _____
11 _____	_____	11 _____
12 _____	_____	12 _____
13 _____	_____	13 _____
14 _____	_____	14 _____
15 _____	_____	15 _____

APPENDIX C
INSTRUCTION SHEET-ROLE CONSTRUCT REPERTORY GRID

Start with the Role Specification Sheet. Beginning with your mother's name, write the first names of the persons described along the numbered diagonals at the top of your Response Sheet. If you know two persons with the same name, better use a last initial as well. If you cannot remember a person's first name, write his last name or something about him which will clearly bring to your mind the person's identity. You do not have to give a perfect fit for each category on the Role Specification Sheet. If you cannot think of someone to fill a category, put someone in the slot and place an "X" after it.

Take your Response Sheet and look at the center grid section. This section has 15 columns and 15 rows. To the far left of this grid section is a broad column marked "Construct." Under this column there are 15 lines or rows. To the far right of the grid section is another broad column marked "Contrast." There are 15 lines or rows under this column. You will be writing in these spaces under these columns.

Look at row 1 of the grid section. Note that the three spaces under the names 1, 7, and 10 have circles in them. Think about these three people. Are two of them alike in some important way that distinguish them from the third person. Keep thinking about them until you remember the important way in which two of them are alike and which sets them off from the third person. When you have decided which two

they are and the important way in which they are alike, put the letter "A" in the two circles corresponding to the two who are alike. Do not put any mark in the third circle. Now write in the space under "Construct" the word or phrase that tells how these two are alike. Now write in the space under "Contrast" what you consider to be the opposite of this characteristic.

Now consider each of the other persons whose names appear. In addition to the two persons whom you have marked with an "A," which ones also have this important characteristic? Put the letter "A" in the box under the name of each other person who has this important characteristic that you wrote under the word "Construct." Next look at what you have written under the word "Contrast." Put the letter "X" in the box of each person who has this characteristic. If you cannot decided whether to rate a person "A" or "X" or if neither the construct "A" nor the contrast "X" applies to the person, leave that box blank. After you have completed your descriptions in row 1. consider the three people who have circles in their respective boxes in row 2. Compare them in the same way you did before. Fill in the blanks under columns 1 and 2 as you did before and then fill in the boxes of the grid section following previous instructions. After you have completed all the spaces under columns 1 and 2, you are ready for the next task.

APPENDIX D
INSTRUCTION SHEET-ORDINATION

Task 1

Record the names of the persons listed on the Response Sheet on the 13 point rating scale sheets. Place the name of the person on the first diagonal at the top of the first form sheet. Place the name of the person from the second diagonal at the top of the second sheet, etc. Rate each person listed on the top of each sheet on the fifteen scales by circling a number which best represents your description of him. For example, if the first scale is,

Honest. . . . . .Dishonest
6 5 4 3 2 1 0 1 2 3 4 5 6

rate the person toward the 6 on the left if you see him as very honest, and toward the 6 on the right if you see him as very dishonest.

After you have finished your ratings, look at each description under columns 1 and 2 and place a "+," "-," "?," or "N" after each description according to whether you feel a characteristic is more favorable "+," more unfavorable "-," cannot decide "?," or is neither favorable or unfavorable "N."

APPENDIX E
INSTRUCTION SHEET-DETERMINING THE NGS SCORE

In this part of the experiment we would like you first to write the names of the acquaintances you earlier listed on your Response Sheet on the 15 cards provided you. List one individual to a card. When you have done this, use these cards to place these 15 individuals into groups based upon their similarity on each of the 15 bipolar construct dimensions you wrote down earlier. Think of each construct dimension one at a time and group together people who seem to you to be similar with regard to that characteristic. You may place all the people in one group if you feel that all are similar with regard to the attribute under consideration or you may have 15 different groups if all the people are different in terms of this same quality. After you have decided how you are going to classify each of your acquaintances, count the number of groups you have formed and place this number in the space provided on the last page of the Response Sheet. When you have finished with the first construct dimension, proceed to the second construct and reclassify your acquaintances on this dimension. Continue in this manner until you have classified all your acquaintances on each construct dimension. Remember, there are no right or wrong answers on this task and no optimal number of groupings.

APPENDIX F
CONCEPTUAL SYSTEMS TEST

Personal Opinion Scale

Scale A

The following is a study of what the general public thinks and feels about a number of important social and personal questions. The best answer to each statement below is your personal opinion. We have tried to cover many different and opposing points of view; you may find yourself agreeing strongly with some of the statements, disagreeing just as strongly with others, and perhaps uncertain about others; whether you agree or disagree with any statement, you can be sure that many people feel the same as you do.

Please mark each statement on the answer sheet by filling in the space under +3, +2, +1 or -1, -2, -3, depending on how you feel in each case.

+3	I AGREE VERY MUCH	-1	I DISAGREE A LITTLE
+2	I AGREE ON THE WHOLE	-2	I DISAGREE ON THE WHOLE
+1	I AGREE A LITTLE	-3	I DISAGREE VERY MUCH

1. I think I have more friends than most people I know.

2. Contributing to human welfare is the most satisfying human endeavor.

3. I feel like blaming others when things go wrong for me.

4. No man can be fully successful in life without belief or faith in divine guidance.

5. I feel like telling other people off when I disagree with them.

6. More and more I feel helpless in the face of what is happening in the world.

7. I like to criticize people who are in a position of authority.

8. It hurts me when anybody is angry at me.

9. I like to join clubs or social groups.

10. Any written work that I do I like to have precise, neat, and well organized.

11. It is safest to assume that all people have a vicious streak, and it will come out when they are given a chance.

12. I like to have my meals organized and a definite time set aside for eating.

13. I like to do things with my friends rather than by myself.

14. Religion is best viewed as a social institution.

15. There is no excuse for lying to someone else.

16. I like to help other people who are less fortunate than I am.

17. I like my friends to confide in me and to tell me their troubles.

18. I like to have my work organized and planned before beginning it.

19. Government officials are as interested in serving the poor as others.

20. I feel like making fun of people who do things that I regard as stupid.

21. Sin is but a cultural concept built by man.

22. I like to keep my things neat and orderly on my desk or workspace.

23. I prefer clear-cut fiction over involved plots.

24. Honesty is the best policy in all cases.

25. I think I am stricter about right and wrong than most people.

26. I believe that to attain my goals it is only necessary for me to live as God would have me live.

27. I prefer a story that has two themes rather than one that has five or six themes going at once.

28. I like to form new friendships.

29. These days a person does not really know whom he can count on.

30. Politicians have to bribe people.

31. I like to start conversation.

32. I feel like getting revenge when someone has insulted me.

33. All in all, it is better to be humble and honest than to be important and dishonest.

34. I don't like to work on a problem unless there is a possibility of coming out with a clear-cut answer.

35. I like to sympathize with my friends when they are hurt or sick.

36. I like to plan and organize the details of any work I undertake.

37. Most people who get ahead in the world lead clean, moral lives.

38. Guilt results from violation of God's law.

39. I like to give lots of parties.

40. One should take action only when sure it is morally right.

41. I like to make as many friends as I can.

APPENDIX G
TEACHER RATING FORM

Name _____

SS# _____

Below you will see ten dimensions which could be used to rate teachers at the University of Florida. What we want you to do is rate the extent to which you would prefer to use each of these dimensions in rating teachers you have had in the past. We want you to indicate which dimensions you feel are the most important considerations by rating your preference by marking a point on the 10-point scale provided for each dimension. The closer to 10 that you rate the dimension, the more important you see it as being. Ratings close to 1 indicate that you feel these dimensions do not represent important characteristics for rating teachers.

1. The fairness of the grading.

1....2....3....4....5....6....7....8....9....10

2. The personal enjoyment the teacher gets from teaching.

1....2....3....4....5....6....7....8....9....10

3. The way the teacher reacts to questions.

1....2....3....4....5....6....7....8....9....10

4. The teacher's understanding of students.

1....2....3....4....5....6....7....8....9....10

5. The extent to which lectures are entertaining.

1....2....3....4....5....6....7....8....9....10

6. The appearance of the teacher and his/her professional attitude.

1....2....3....4....5....6....7....8....9....10

7. The teacher's use of relevant demonstrations.

1....2....3....4....5....6....7....8....9....10

8. The teacher's concern for the students.

1....2....3....4....5....6....7....8....9....10

9. The teacher's commitment to teaching.

1....2....3....4....5....6....7....8....9....10

10. The teacher's excitement for the subject matter of the course.

1....2....3....4....5....6....7....8....9....10

APPENDIX H
HEALTH OPINION SURVEY

This inventory consists of numbered statements. Read each statement and decide whether it is true as applied to you or false as applied to you.

You are to mark your answers on the answer sheet. If a statement is TRUE or MOSTLY TRUE, as applied to you, blacken the space in the column headed 1. If a statement is FALSE or NOT USUALLY TRUE, as applied to you, blacken the space in the column headed 2. If a statement does not apply to you or if it is something that you do not know about, make no mark on the answer sheet.

Remember to give YOUR OWN opinion of yourself. Do not leave any blank spaces if you can avoid it.

In marking your answers on the answer sheet, be sure that the number of the statement agrees with the number on the answer sheet. Make your marks heavy and black. Erase completely any answer you wish to change.

1. I wake up fresh and rested most mornings.

2. My hands and feet are usually warm enough.

3. My daily life is full of things that keep me interested.

4. There seems to be a lump in my throat much of the time.

5. Once in a while I think of things too bad to talk about.

6. At times I have fits of laughing and crying that I cannot control.

7. I feel that it is certainly best to keep my mouth shut when I am in trouble.

8. I find it hard to keep my mind on a task or job.

9. I seldom worry about my health.

10. I have had periods of days, weeks, or months when I could not take care of things because I could not "get along."

11. My sleep is fitful and disturbed.

12. Much of the time my head seems to hurt all over.

13. I am in just as good physical health as most of my friends.

14. I prefer to pass by school friends, or people I know but have not seen for a long time, unless they speak to me first.

15. I am almost never bothered by pains over the heart or in my chest.

16. I am a good mixer.

17. I wish I could be as happy as others seem to be.

18. Most of the time I feel blue.

19. I am certainly lacking in self-confidence.

20. I usually feel that life is worthwhile.

21. It takes a lot of argument to convince most people of the truth.

22. I think most people would lie to get ahead.

23. I do many things which I regret afterwards (I regret things more often than others seem to do).

24. I have very few quarrels with members of my family.

25. My hardest battles are with myself.

26. I have little or no trouble with my muscles twitching or jumping.

27. I do not seem to care what happens to me.

28. Much of the time I feel as if I have done something wrong or evil.

29. I am happy most of the time.

30. Some people are so bossy that I feel like doing the opposite of what they request, even though I know they are right.

31. Often I feel as if there were a tight band about my head.

32. I seem to be about as capable and smart as most others around me.

33. Most people will use somewhat unfair means to gain profit or an advantage rather than to lose it.

34. Often I cannot understand why I have been so cross and grouchy.

35. I do not worry about catching diseases.

36. I commonly wonder what hidden reason another person may have for doing something nice for me.

37. Criticism or scolding hurts me terribly.

38. My conduct is largely controlled by the customs of those about me.

39. I certainly feel useless at times.

40. At times I feel like picking a fist fight with someone.

41. I have often lost out on things because I could not make up my mind soon enough.

42. It makes me impatient to have people ask my advice or otherwise interrupt me when I am working on something important.

43. Most nights I go to sleep without thoughts or ideas bothering me.

44. I cry easily.

45. I cannot understand what I read as well as I used to.

46. I have never felt better in my life than I do now.

47. I resent having anyone take me in so cleverly that I have had to admit that it was one on me.

48. I do not tire quickly.

49. I like to study and read about things that I am working at.

50. I like to know some important people because it makes me feel important.

51. It makes me uncomfortable to put on a stunt at a party even when others are doing the same sort of things.

52. I frequently have to fight against showing that I am bashful.

53. I seldom or never have dizzy spells.

54. My memory seems to be all right.

55. I am worried about sex matters.

56. I find it hard to make talk when I meet new people.

57. I am afraid of losing my mind.

58. I frequently notice my hand shakes when I try to do something.

59. I can read a long while without tiring my eyes.

60. I feel weak all over much of the time.

61. I have very few headaches.

62. Sometimes, when embarrassed, I break out in a sweat which annoys me greatly.

63. I have had no difficulty in keeping my balance in walking.

64. I wish I were not so shy.

65. I enjoy many different kinds of play and recreation.

66. In walking I am very careful to step over sidewalk cracks.

67. I frequently find myself worrying about something.

68. I hardly ever notice my heart pounding, and I am seldom short of breath.

69. I brood a great deal.

70. I have periods of such great restlessness that I cannot sit long in a chair.

71. I dream frequently about things that are best kept to myself.

72. I believe I am no more nervous than most others.

73. I have few or no pains.

74. Sometimes without any reason or even when things are going wrong, I feel excitedly happy, "on top of the world."

75. I sweat very easily even on cool days.

76. Once a week or more often I become very excited.

77. When in a group of people, I have trouble thinking of the right things to talk about.

78. When I leave home, I do not worry about whether the door is locked and the windows closed.

79. I do not blame a person for taking advantage of someone who lays himself open to it.

80. I drink an unusually large amount of water every day.

81. Once in awhile I laugh at a dirty joke.

82. I work under a great deal of tension.

83. I am likely not to speak to people until they speak to me.

84. I have periods in which I feel unusually cheerful without any special reason.

85. In school I found it very hard to talk before the class.

86. Even when I am with people I feel lonely much of the time.

87. I think nearly anyone would tell a lie to keep out of trouble.

88. I am easily embarrassed.

89. I worry over money and business.

90. I almost never dream.

91. I feel anxiety about something or someone almost all of the time.

92. Sometimes I become so excited that I find it hard to get to sleep.

93. I forget right away what people say to me.

94. I usually have to stop and think before I act even in trifling matters.

95. Often I cross the street in order not to meet someone I see.

96. I often feel as if things were not real.

97. I have a habit of counting things that are not important such as bulbs on electric signs, and so forth.

98. I have strange and peculiar thoughts.

99. I get anxious and upset when I have to make a short trip away from home.

100. I have no dread of going into a room by myself where other people have already gathered and are talking.

101. I have more trouble concentrating than others seem to have.

102. I have several times given up doing a thing because I thought too little of my ability.

103. Bad words, often terrible words, come into my mind and I cannot get rid of them.

104. Sometimes some unimportant thought will run through my mind and bother me for days.

105. Almost every day something happens to frighten me.

106. I am inclined to take things hard.

107. I am more sensitive than most other people.

108. At periods my mind seems to work more slowly than usual.

109. I very seldom have spells of the blues.

110. I wish I could get over worrying about things I have said that may have injured other people's feelings.

111. People often disappoint me.

112. I feel unable to tell anyone all about myself.

113. My plans have frequently seemed so full of difficulties that I have had to give them up.

114. Often, even though everything is going fine for me, I feel that I do not care about anything.

115. I have sometimes felt that difficulties were piling up so high that I could not overcome them.

116. I often think, "I wish I were a child again."

117. I have often met people who were supposed to be experts who were no better than I.

118. I am apt to take disappointments so keenly that I cannot put them out of my mind.

119. At times I think I am no good at all.

120. I worry quite a bit over possible misfortunes.

121. I am apt to pass up something I want to do because others feel that I am not going about it in the right way.

122. I find it hard to set aside a task that I have undertaken, even for a short time.

123. I must admit that I have at times been worried beyond reason over something that really did not matter.

124. I have often felt guilty because I have pretended to feel more sorry about something than I really was.

125. I feel tired a good deal of the time.

126. I sometimes feel that I am about to go to pieces.

APPENDIX I
INSTRUCTION SHEET-EMBEDDED FIGURES TEST

> I am going to show you a series of colored designs. Each time I show you one, I want you to describe it in any way you wish. I will then show you a Simple Design which is contained in that larger design. Then I will take the Simple Form away. You will then be given the larger design again, and your job will be to locate the Simple Design in it. Let's go through a practice trial to show you how it is done.

E shows the Practice Complex Figure for 15 seconds. Then, E covers it by placing the Practice Simple Form over it. After 10 seconds E says:

> I will now show you the colored design again and you are to find the Simple Form in it. As soon as you have found the Simple Form, let me know and start tracing the Simple Form with this stylus. When you are tracing, do not let the stylus touch the surface of the card.

E then exposes the Complex Figure again by removing the Simple Figure and turning it over. E begins timing from zero. As soon as S states that the Simple Form was seen, E notes the time, but the stop-watch is kept running in case S has made an error in locating the Simple Form. In the case of an error, E responds, "No, that is not it. Keep trying."

S is told,

> This is how we will proceed on all trials. In every case the Simple Design will be present in the Complex Design. It will always be in the upright position, so do not turn the card around. There may be several of the Simple Designs in the Complex Design, but you are to find and trace only one of them. Work as quickly as you possibly can,

since I will be timing you, but be sure that the Design you find is exactly the same as the original Simple Design in shape, size, and proportion. As soon as you have found the Design, tell me at once and start to trace it. If you ever forget what the Simple Design looks like, you may ask me to see it again, and you may do this as often as you like. Are there any questions?

E presents the first Complex Figure.

APPENDIX J
INTUITIVE REASONING INSTRUMENT

Here are 20 problems for you to solve. Each problem is separate from the others. Clues are provided to help you arrive at the solution for each problem. You are to solve each problem using as few clues as possible.

For each problem the clues which will help you solve it are covered by foil seals which you can see through the openings in the problem board. Pressing your stylus through the foil and pushing the foil back allows you to see a clue. There is a clue under each seal.

In some of the problems part of the answer is already on the answer sheet so be sure to look at the answer sheet before you attack each problem. In reaching your solution to any problem, you must reach a final solution as though you has used ALL THE CLUES for that problem--both those you have seen and those you have not seen (see example below).

If you think you know the solution to a problem without looking at any clues, go ahead and write it on the answer sheet in the appropriate place. If you want to see a clue, carefully break the foil in the first opening. If, when you see the clue, you think you know the answer, write it down. If not, carefully break the next seal, and so on until you either reach a solution or you have exhausted the supply of clues. Use the clues in order. Give a solution to each problem no

matter how unsure you may be. Be careful that you do not break a seal unless you really need the clue which is covered by that seal. Inspect your problem board now to be sure all seals are intact. If any are broken, report this to the examiner.

One's first reaction may be "but what is the problem?" The use of clues will help you decide what the problem is--and then help you arrive at the solution to it. You, therefore, must discover the nature of the problem through the use of the clues.

Your confidence in the solutions you reach will vary from problem to problem. Please indicate how confident you are of each solution by placing the appropriate number on the following scale after your solution.

(4) certain

(3) fairly confident

(2) unsure

(1) wild guess

Draw a circle around your confidence rating to distinguish it from your solution to the problem. There is no time limit, but we will record how long each person takes on the task. Take as much time as you need, but do not waste time. If you do not know the answer to a problem, guess and go on to the next problem.

You may use the back of the answer sheet for scratch paper if you wish. Work independently and please do not talk about the experiment with anyone who may be in it. We will be using many people as subjects and advance knowledge about the nature of this task will invalidate our work and make it useless. When you are finished, give your problem board and answer sheet to the experimenter.

REMEMBER: THE OBJECT IS TO WORK OUT THE SOLUTION TO EACH PROBLEM USING AS FEW CLUES AS POSSIBLE.

*Example of a problem solved correctly:

CLUES		INTACT SEALS WITH UNSEEN CLUES			solution	confidence
(Jan.)	(Feb.)	( )	( )	( )	1. June 4	2
(/ /)	(/ /)	(/ /)	(/ /)	(/ /)	2.	

Note that the answer mades use of the three clues which were not seen, as per the instructions.

Note the number of clues used for each problem after the answer and confidence ratings.

REFERENCES

Adams-Webber, J. R. Cognitive complexity and sociality. British Journal of Social and Clinical Psychology, 1969, 8, 211-216.

Allard, R., & Carlson, E. R. The generality of cognitive complexity. Journal of Social Psychology, 1963, 59, 73-75.

Angyal, A. Foundations for a science of personality. New York: Commonwealth Fund, 1941.

Bannister, D. Conceptual structure in thought disordered schizophrenics. Journal of Mental Science, 1960, 106, 1230-1249.

Bannister, D. The nature and measurement of schizophrenic thought disorder. Journal of Mental Science, 1962, 108, 825.

Bannister, D., & Mair, B. M. The evaluation of personal constructs. London & New York: Academic Press, 1968.

Bavelas, J. B., Chan, A. S., & Guthrie, J. A. Reliability and validity of traits measured by Kelly's Repertory Grid. Canadian Journal of Behavioral Science, 1976, 8, 23-38.

Bieri, J. Cognitive complexity - simplicity and predictive behavior. Journal of Abnormal and Social Psychology, 1955, 51, 263-268.

Bieri, J. Cognitive complexity and personality development. In O. J. Harvey (Ed.), Experience, structure, and adaptability. New York: Springer, 1966.

Bieri, J., Atkins, A. L., Briari, S., Leamon, R. L., & Tripodi, T. Clinical and social judgement. New York: Wiley, 1966.

Bieri, J., & Blacker, E. The generality of cognitive complexity in the perception of people and inkblots. Journal of Abnormal and Social Psychology, 1956, 53, 112-117.

Bieri, J., Bradburn, W. M., & Galinsky, M. D. Sex differences in perceptual behavior. Journal of Personality, 1958, 26, 1-12.

Bieri, J., & Messerley, S. Differences in perceptual and cognitive behavior as a function of experience type. Journal of Consulting Psychology, 1957, 21, 217-221.

Byrne, D. The Repression-Sensitization scale: Rationale, reliability and validity. Journal of Personality, 1961, 29, 334-349.

Byrne, D., Barry, J., & Nelson, D. Relation of the revised Repression - Sensitization scale to measures of self-description. Psychological Reports, 1963, 13, 323-334.

Campbell, V. N. Assumed similarity, perceived sociometric balance, and social influence. Doctoral dissertation, University of Colorado, 1960. Cited in Crockett, W. Cognitive complexity and impression formation. In B. Maher, Progress in experimental personality research, Vol. 2, New York: Academic Press, 1965.

Caracena, F. K., & King, G. Generality of individidual differences in complexity. Journal of Clinical Psychology, 1962, 18, 234-236.

Crockett, W. Cognitive complexity and impression formation. In B. Maher, Progress in experimental personality research, Vol. 2, New York: Academic Press, 1965.

Crockett, W. H., & Meisel, P. Construct connectedness, strength of disconfirmation, and impression change. Journal of Personality, 1974, 42, 290-299.

Epting, F. R. Cognitive complexity and persuasibility across cognitive domains. Doctoral dissertation, Ohio State University, 1967.

Epting, F., & Wilkins, G. Comparison of cognitive structural measures for predicting person perception. Perceptual and Motor Skills, 1974, 38, 727-730.

Harvey, O. J. System structure, flexibility and creativity. In O. J. Harvey (Ed.) Experience, structure, and adaptability. New York: Springer, 1966.

Harvey, O. J. Conceptual systems and attitude change. In W. Sherif, & M. Sherif, (Eds.), Attitude, ego-involvement and attitude change. New York: Wiley, 1967.

Harvey, O. J., Hunt, D. E., & Schroder, H. M. Conceptual systems and personality organization. New York: Wiley, 1961.

Harvey, O. J., Prater, M., White, B. J., & Hoffmeister, J. K. Teacher's beliefs, classroom atmosphere and student behavior. American Educational Research Journal, 1968, 5, 151-166.

Hayden, B. The self and possibilities for change. Unpublished manuscript, Brown University, 1977.

Hayes, W. L. An approach to the study of trait implication and trait similarity. In R. Tagiuri & L. Petrullo, (Eds.), Person perception and interpersonal behavior. Stanford University Press, 1958.

Hill, M. F. The generality and interaction of cognitive complexity simplicity. Doctoral dissertation, Vanderbilt University, 1966.

Hinkle, D. D. The change of personal constructs from the viewpoint of a theory of implications. Doctoral dissertation, Ohio State University, 1965.

Irwin, M., Tripodi, T., & Bieri, J. Affective stimulus value and cognitive complexity. Journal of Personality and Social Psychology, 1967, 5, 444-448.

Jaspars, J. M. F. Individual's cognitive structures. Proceedings from the 17th International Congress on Psychology, Washington, 1963.

Kelly, G. A. The psychology of personal constructs. Vol. 1, New York: W. W. Norton, 1955.

Kelly, J. V. A program for processing George Kelly's Rep Grids. Unpublished manuscript, Ohio State University, 1963.

Landfield, A. W. Personal construct systems in psychotherapy. Chicago: Rand McNally, 1971.

Landfield, A. W., & Barr, M. A. Ordination: A new measure of concept organization. Unpublished manuscript, University of Nebraska, 1975.

Langley, C. W. Differentiation and integration of systems of personal construct. Journal of Personality, 1971, 39, 10-25.

Leitner, L., Landfield, A. W., & Barr, M. A. Cognitive complexity: A review. Unpublished manuscript, University of Nebraska, 1976.

Leventhal, H. Cognitive processes and interpersonal predictions. Journal of Abnormal and Social Psychology, 1957, 55, 176-180.

Leventhal, H., & Singer, D. L. Cognitive complexity, impression formation, and impression change. Journal of Personality, 1964, 32, 210-226.

Lewin, K. Field theory in social science: Selected theoretical papers. D. Cartwright (Ed.), New York: Harper & Row, 1951.

Lundy, R. M., & Berkowitz, L. Cognitive complexity and assimilative projection in attitude change. Journal of Abnormal and Social Psychology, 1957, 55, 34-37.

MacNeil, L. W. Cognitive complexity: A brief synthesis of theoretical approaches and a concept attainment task analogue to cognitive structure. Psychological Reports, 1974, 34, 3-11.

Mayo, C. W., & Crockett, W. H. Cognitive complexity and primacy-recency effects in impression formation. Journal of Abnormal and Social Psychology, 1964, 68, 335-338.

Miller, A. D. Amount of information and stimulus valence as determinants of cognitive complexity. Journal of Personality, 1969, 37, 141-157.

Miller, A. D., & Bieri, J. Cognitive complexity as a function of the significance of the stimulus objects being judged. Psychological Reports, 1965, 16, 1203-1204.

Renner, K. E., & Maher, B. A. Effect of contruct type on recall. Journal of Individual Psychology, 1962, 18, 177-179.

Rosenkrantz, P. S. Relationship of some conditions of presentation and cognitive differentiation to impression formation. Doctoral dissertation, Clark University, Worcester, Massachusetts, 1961.

Runkel, P. J., & Damrin, D. E. Effects of training and anxiety upon teachers' preference for information about students. Journal of Educational Psychology, 1961, 52, 254.

Schneier, C. E. Cognitive structure and preference for constructs in impression formation: A field experiment. Unpublished manuscript, University of Maryland, 1976.

Schroder, H., Driver, M., & Streufert, S. Human information processing. New York: Holt, Rinehart, & Winston, 1967.

Scott, W. A. Cognitive complexity and cognitive flexibility. Sociometry, 1962, 25, 405-414.

Scott, W. A. Cognitive complexity and cognitive balance. Sociometry, 1963, 25, 66-74.

Sechrest, L. B., & Jackson, D. N. Social intelligence and accuracy of interpersonal predictions. Journal of Personality, 1961, 29, 167-181.

Shephard, J. W. The effects of variations in the evaluativeness of traits on the relation between stimulus affect and cognitive complexity. Journal of Social Psychology, 1972, 88, 233-239.

Slane, S., & Barrows, D. Unpublished data, 1974, Cited in Leitner, L., Landfield, A. W., & Barr, M. A. Cognitive complexity: A review. Unpublished manuscript, University of Nebraska, 1976.

Streufert, S., & Driver, M. J. Conceptual structure, information load and perceptual complexity. Psychonomic Science, 1966, 3, 249-250.

Tempone, V. J. Differential thresholds of repressors and sensitizers as a function of a success and failure experience. Doctoral dissertation, University of Texas, 1962.

Todd, F. J., & Rappoport, L. A. A cognitive structure approach to person perception: A comparison of two models. Journal of Abnormal and Social Psychology, 1964, 68, 469-478.

Tripodi, T., & Bieri, J. Cognitive complexity as a function of own and provided constructs. Psycholocial Reports, 1963, 13, 16.

Vannoy, J. S. Generality of cognitive complexity-simplicity as a personality concept. Journal of Personality and Social Psychology, 1965, 2, 385-396.

Werner, H. The concept of development from a comparative and organismic point of view. In D. B. Harris (Ed.), The concept of development: an issue in the study of human behavior. Minneapolis: University of Minnesota Press, 1957.

Wescott, M. R. On the measurement of intuitive leaps. Psychological Reports, 1961, 9 , 267-274.

Wescott, M. R. Toward a contemporary psychology of intuition. New York: Holt, Rinehart, and Winston, 1968.

Wilkins, G., Epting, F. R., & Van de Riet, H. Relationship between Repression-Sensitization and interpersonal cognitive complexity. Journal of Consulting and Clinical Psychology, 1972, 36, 111-118.

Witkin, H. A. Individual differences in ease of perception of embedded figures. Journal of Personality, 1950, 19, 1-15.

Witkin, H. A. Social influences in the development of cognitive style. In D. A. Goslin, Handbook of socialization theory and research. Chicago: Rand McNally, 1969.

Witkin, H. A., Dyk, R. B., Faterson, H. F., Goodenough, D. R., & Karp, S. A. Psychological differentiation. New York: Wiley, 1962.

Zajonc, R. B. The process of cognitive tuning in communication. Journal of Abnormal and Social Psychology, 1960, 61, 159-167.

Zimring, F. Cognitive simplicity-complexity: evidence for disparate processes. Journal of Personality, 1971, 39, 1-9.

BIOGRAPHICAL SKETCH

John L. Crum was born on February 20, 1951, in Frederick, Maryland. He graduated from Gov. Thomas Johnson High School, also in Frederick, in 1969. From here he went on to attend and receive his Bachelor of Arts Degree, with honors and Distinction in Psychology, from Boston University in 1973.

In September of 1973, John entered the graduate program in Psychology at the University of Florida, from which he received a Master of Arts Degree in 1975. On September 13, 1975, John married Barbara Diane Koenig, formerly of Baldwin, New York, who was also a graduate of Boston University.

Thus far, John has interests in both personal construct theory and memory processes. Additionally, he is an avid sports enthusiast. Upon completion of his doctorate, he plans to pursue a career in applied research.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Franz R. Epting, Chairman
Associate Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Ira S. Fischler
Assistant Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Dorothy D. Nevill
Associate Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Richard J. Anderson

Richard J. Anderson
Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Gordon G. Bechtel

Gordon G. Bechtel
Professor of Marketing

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Robert E. Allen

Robert E. Allen
Associate Professor of Physical Education

This dissertation was submitted to the Graduate Faculty of the Department of Psychology in the College of Arts and Sciences and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December, 1977

_____

Dean, Graduate School